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DISCUSSION PAPER NO. 364

A General Equilibrium Analysis of the Canadian-United States Bilateral Trade Agreement

by

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and James R. Williams

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RÉSUMÉ

L'accord de libre-échange entre le Canada et les États-Unis provoquera une transformation profonde qui sera ressentie dans l'ensemble de l'économie. Toutes les industries seront touchées, et les changements qui se produiront dans chacune d'elles se répercuteront sur toutes les autres. Il est donc impossible d'analyser les effets de l'accord uniquement à l'aide d'un modèle d'équilibre partiel. Il faut plutôt recourir à une analyse d'équilibre général dans laquelle tous les secteurs industriels et les facteurs économiques interviennent simultanément. Aussi avons-nous élaboré, aux fins de la présente étude, un modèle d'équilibre général qui distingue 92 catégories de marchandises et 43 branches d'activité. Cette méthode nous permet de déterminer explicitement les valeurs des prix et de la production en fonction de l'offre et de la demande dans chaque branche industrielle. Les variations des coûts et des prix relatifs attribuables à la suppression des barrières commerciales sont calculées sans omettre aucun aspect de l'interdépendance entre toutes les industries. Notre analyse nous permet en particulier d'évaluer l'effet de l'accord de libre-échange sur les exportations du Canada vers les États-Unis et le reste du monde, sur les importations canadiennes de marchandises semblables à des fins de consommation ou de production, sur les niveaux de production, sur l'utilisation dans chaque industrie du capital, de la main-d'oeuvre et des marchandises produites au Canada et, enfin, sur la consommation des marchandises dans le secteur des ménages. Le modèle permet également de calculer le prix de chaque catégorie de marchandise et les coûts auxquels chaque industrie fait face.

L'entente canado-américaine de libre-échange accroîtra le niveau de vie des Canadiens. À ce chapitre, nos résultats prévoient une augmentation d'entre 0,5 et 4,2 %. Cette fourchette est essentiellement la même que celle des autres chercheurs qui prédisent un gain de 0,7 % à 3,3 %. Si le dernier chiffre de notre fourchette de croissance est un peu plus élevé, c'est que nous posons deux hypothèses importantes : premièrement, que des économies d'échelle seront réalisées au niveau des usines individuelles et, deuxièmement, que les produits canadiens se vendront sur le marché nord-américain à des prix (en dollars U.S.) voisins des prix actuels des produits américains analogues. Cette conclusion corrobore l'analyse publiée il y a quelques années par Harris et Cox (1983) et l'étude plus récente du ministère des Finances (1988). Le premier chiffre de notre fourchette de croissance, qui est de 0,5 % seulement, est à peu près le même que celui obtenu par Hamilton et Whalley (1985), qui n'ont pas inclus une hypothèse sur les économies d'échelle. Le ministère des Finances (1988), en se servant d'un modèle semblable à celui de Harris et Cox (1983), a calculé que les gains seraient de 2,5 %

seulement. Son modèle comporte une estimation plus élevée (d'environ 25 %) des économies d'échelle, mais des hypothèses moins optimistes sur les élasticités. En dernière analyse, il paraît raisonnable de s'attendre à des gains économiques de 2,5 % à 4,0 % pour l'économie canadienne.

Dans la plupart des analyses d'équilibre général, l'offre de travail est traitée comme une constante. Nos résultats indiquent qu'il y aura une hausse de 2 % dans le demande de main-d'oeuvre et il est intéressant de comparer nos chiffres avec ceux présentés dans une étude récente du Conseil économique du Canada, intitulée Commerce sans frontières (Document N° 344). Cette dernière a été réalisée à l'aide du modèle économétrique CANDIDE. Les auteurs ont fait la même hypothèse que nous au sujet des économies d'échelle, mais les élasticités qu'ils ont utilisées sont moins élevées que les nôtres. Selon leurs résultats, le nombre d'emplois devrait augmenter de 2,3 %, ce qui est proche de l'augmentation de 2,07 % que nous avons obtenue dans le scénario n° 6. Toutefois, les auteurs du Document n° 346 ont prédit un changement de 2,3 % dans les salaires réels, ce qui est nettement inférieur au 7,1 % que nous avons estimé. Cette différence s'explique par l'hypothèse plus optimiste que nous avons adoptée sur les élasticités des exportations, laquelle entraîne une plus forte croissance de la consommation et de la dépense nationale brute, et par une baisse d'environ 3 % dans le rendement du revenu du capital. Si nos chiffres sont exacts, l'accord de libre-échange sera beaucoup plus bénéfique aux travailleurs que les auteurs de Commerce sans frontières ne l'avaient prévu et l'augmentation des salaires pourrait même atteindre 11 %*.

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* 1,11 = 1,02 x 1,07

ABSTRACT

The Canada-U.S. Free Trade Agreement introduces a comprehensive change which will have economy-wide effects. All industries are affected, yet, the change in any one of them will affect all others. Therefore, one cannot analyze the impact of the Agreement by using a partial equilibrium approach. Rather, the analysis should be based on a general equilibrium approach, where all industrial sectors and economic factors are considered simultaneously. Accordingly, this study constructs the general equilibrium model of 92 commodities and 43 industrial classes. In this approach, prices and outputs are explicitly calculated from the demand and supply conditions in each industry. The changes in relative costs and prices that will result from changing trade barriers are calculated after fully taking into account the interdependence of all industries. Our analysis, in particular, determines the impact of the Agreement on Canada's exports to the United States and to the Rest of the World, on its imports from these two areas of similar classes of commodities for consumption or for use in production, changes in the levels of production, the use in each industry of capital, labour and of domestically produced commodities and, finally, the consumption of commodities by households. Simultaneously, prices are determined for each commodity class and costs for each industry.

The bilateral trade agreement with the United States will increase Canada's standard of living. Our results indicate that the amount of increase will vary between 0.5 to 4.3 per cent. This conclusion is in general agreement with the 0.7 to 3.3 range obtained in other studies. Two key assumptions are necessary to obtain the higher figure. Plant level economies of scale must be present and Canadian products must be accepted in the North American market at prices (in U.S. currency) near those currently charged for similar U.S. goods. This conclusion agrees with the earlier study of Harris and Cox (1983) and the more recent study of the Department of Finance (1988). Our lower figure indicating gains of only 0.5 per cent is approximately that obtained by Hamilton and Whalley (1985) who do not incorporate an economies of scale assumption. In a model similar to that of Harris and Cox (1983) published by the Department of Finance (1988) gains of only 2.5 per cent are reported. The Department of Finance (1988) estimate uses a more optimistic estimate of scale economies (by about 25 per cent) but less optimistic assumptions regarding the elasticities. Perhaps it is reasonable to take the range 2.5 - 4.0 per cent as a reasonable expectation for the economic gains to Canada from the Canada-U.S. Free Trade Agreement.

Most general equilibrium studies take the quantity of labour supplied as constant. We may, however, compare our results indicating an increase of 2 per cent in labour requirements to those

reported in the recent study of the Economic Council of Canada Open Borders (Discussion Paper 344). Open Borders uses the macro-econometric CANDIDE Model. With economies of scale present at a level also assumed by this study but with elasticities which are lower, Open Borders indicates an increase in employment of 2.3 per cent which is similar to our figure of 2.07 in scenario 6. The D.P. 344 estimate of the change in the real wages of 2.3 per cent, however, is considerably less than our figure of 7.1 per cent. This higher percentage in this study is explained by the more optimistic assumption concerning the export elasticities which gives us a higher growth in consumption and gross national expenditure, and by a decline in the return on income from property of about 3 per cent. If correct, the benefits to labour from the Agreement would be significantly greater than previously estimated in Open Borders, leading to an increase in the wages paid of as much as 11 per cent.*

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* 1.11 = 1.02 x 1.07

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FOREWORD

This study is part of the Council's research program on Trade Policy Options and Structural Adjustments in Canada. The paper constructs a general equilibrium model of 92 commodities and 43 industries and then simulates the effects of the Canada-U.S. Free Trade Agreement on Canada's relative costs and prices, exports, real wages, output and employment. The general equilibrium approach gives an estimate of the final long term effects of the policy change after all economic adjustments have worked themselves through. The methodology used in this paper is an alternative to that used in the Council's discussion paper Open Borders (D.P. 344), which used a macro-econometric model.

The Economic Council's consensus views of the trade agreement were set out in Venturing Forth - An Assessment of the Canada - U.S. Trade Agreement.

This particular study was commissioned in order to provide a cross check of the results of the macro-econometric model, using a different methodology. Despite the important methodological differences between the general equilibrium model and the macro-econometric model, this new study, like the earlier discussion paper, shows that the bilateral free trade agreement with the United States would increase output and employment and would thus have a positive impact on Canada's standard of living.

Andrew Muller is currently associate professor of Economics and James Williams is professor of Economics at McMaster University, Hamilton, Ontario. Professor Muller has done research on industrial organization issues, while Professor Williams has made important contributions to the modelling of international trade policy.

Judith Maxwell
Chairman

July 1989

PREFACE

The Bilateral Free Trade Agreement between Canada and the United States introduces a comprehensive change which will have Economy-wide effects. All industries are affected, yet, the change in any one of them will affect all others. Under the circumstances, one cannot proceed to analyze them one industry at a time. Accordingly, this study is based on a general equilibrium approach, all aspects of the problem are considered simultaneously. These are described in terms of 92 commodity and 43 industrial classes. We examine the impact of the agreement on Canada's exports to the United States and to the Rest of The World, on her imports from these two areas of similar classes of commodities for consumption or for use in production, changes in the levels production, the use in each industry of capital, labour and of domestically produced commodities and, finally, the consumption of commodities by households. Simultaneously, prices must then be determined for each commodity class and costs for each industry.

We hope to have provided the reader with a useful analysis that takes all the most important economic aspects of the agreement into consideration but there is no attempt here to predict the future. In addition to the agreement, there will be many unpredictable events which will effect the national economy. In essence, we take as unchanged those things which are not directly or indirectly affected by the agreement and which are inherently unpredictable. The agreement itself is the cause of change. The analysis consists of reporting and explaining the new levels of the variables mentioned in the first paragraph above. What we include in the analysis and what exclude, of course, is a matter of judgement. Our own judgement concerning what to include and what to exclude is strongly influenced by The Real Theory of International Trade. This is the body of knowledge developed by economist to explain how international trade restrictions might affect the the national economy. Our particular application and the rationale for our approach is described verbally in Chapter IV. A mathematical treatment is found in Chapter V.

The results are reported in Chapters I - III. There are approximately 800 variables involved and the reader will find some discussion and a complete report on all of them somewhere in these pages. Chapter I focuses on the broader dimensions. The main prices in the system are the wage rate and the terms of trade. The key indicators of performance are the levels of consumption (utility), the real wage and national labour requirements. If the agreement materializes in the legal form it now has, according to these indicators, Canada cannot be worse off. Under the most pessimistic assumptions the gain in living standards would be in the neighborhood of one-half of one percent.

Under more optimistic assumptions, Canada's gains in terms of her living standards could be in the neighborhood of 5 percent and there would be increases in wages and employment. It would be difficult to document any other social change that could create benefits of this magnitude. If it is to be realized, two assumptions are necessary. Firstly, economies through specialization at the level of the firm in the amount assumed in our model must be present. Secondly, Canadian firms must be able to penetrate the United States market without substantially reducing prices. Since exports from both nations must expand, this could be described as a kind of sharing of a combined Canadian-United States market.

Chapter II is concerned with output and employment. Our analysis indicates that there will be output expansion in nearly all industries - especially in the manufacturing industries but, because less labour will be needed per unit of output, employment will fall in some of the manufacturing industries. In Chapter III we discuss the impact on trade. Under both the pessimistic and optimistic assumptions, exports increase - particularly exports of manufactured goods. Under the optimistic set of assumptions exports to all nations except the United States fall (even though total exports increase) because there is an increase in Canada's terms of trade which makes Canadian goods more costly. The effect of this shift is to move the economy toward the later stages of processing. Under the pessimistic assumptions there is an increase in exports to both the rest of the world and to the United States. The bilateral agreement will increase Canadian imports from nations outside North America.

This study has been in preparation since September 1986. At that time, the final form of the bilateral free trade agreement between Canada and the United States was unknown. Our preliminary results, based on what we thought the agreement might be, were submitted to the Council in August 1987 and our final version in November of that year. Shortly after this, the actual terms of the bilateral free trade agreement were announced and the Council decided that we should base this study on the actual agreement. Several months elapsed while the Council reviewed its data in the light of the actual agreement and, after this process was complete, we were able to revise our own results in late Spring, 1988.

Because of the long gestation period, we were able to benefit from advice and criticism from many quarters. A preliminary version of this paper was presented before the Canadian Economic Association in Spring 1987 and a technical report on it at the March 1988 conference of "General Equilibrium Trade Policy Modelling" held at the University of Western Ontario.

It is not possible to mention all the people who offered good advice and criticism but there are a few who were particularly helpful. At the Council itself we received useful comments and continuing support from Sunder Magun, Someshwar Rao and Bimal Lodh. Without the preliminary data set prepared under the direction of Lodh and Magun, this study would not have been possible. We would also like to thank Tom Rutherford, T.N. Srinivasan, John Whalley and Randall Wigle for their useful comments. All errors and omissions remain the full responsibility of the authors.

CHAPTER I

INTRODUCTION

EFFECTS ON KEY INDICATORS

This study is intended to serve as an evaluation of the costs and benefits of a free trade agreement between Canada and the United States. The objective is to compare, within a logically consistent framework, the outcome of a number of scenarios regarding these negotiations. This chapter is a brief statement of our approach, the assumptions it requires and a review of the results relating to certain key indicators: consumption, real wages and employment. Chapter II presents the empirical results on output and employment by industry and Chapter III reports on exports and imports. In Chapter IV there is a detailed discussion of our approach, comparing it to that of others. A description of our methodology in mathematical terms will be found in Chapter IV and its appendix.

ALTERNATIVE APPROACHES TO THE PROBLEM

Continuing trade negotiations, both bilateral and multilateral, have increased the demand for quantitative models capable of simulating the effects of alternative trade regimes on the detailed structure of national economies. In Canada, particular attention has been focussed on bilateral negotiations with the United States and this is the focus of this study, but the multilateral negotiations which are now underway under GATT are also of great importance.

Three general approaches may be taken to the problem of computing the effects of trade policy changes on the national economy. These are input-output analysis, macroeconometric modelling, and general equilibrium modelling.

The simplest and least satisfactory approach is to use a closed input-output model to estimate the changes in output and employment by industry that would occur given an exogenously determined change in final demands. This approach has severe limitations. Most prominently, it assumes an infinitely elastic supply of all factors of production, it does not allow for changes in the relative prices of primary factors and of intermediate commodities, and it does not incorporate any information about the demand for individual commodities. These limitations lead to severe overstatement of the multiplier effect of trade policy changes (since feedback effects which limit demand are ignored) and an inability to model changes in the composition of final demand.

Macro-econometric models are particularly well-suited to assessing the short-run effects of trade policy changes on aggregate employment, interest rates and the price level. These models emphasize the role of monetary variables in limiting the effects of an expansion in aggregate demand. However, they often lack a mechanism to determine the industrial composition of output. Such a mechanism may be created by using input-output tables to distribute changes in final demand across industries, but such a solution cannot model the changes in relative commodity prices which result from changes in relative industrial outputs. Moreover, because macro-econometric models usually focus on short-run disequilibrium, their long-run steady-state behaviour may not satisfy reasonable theoretical requirements.

The third method of modelling the impact of trade policy changes may be termed the general equilibrium approach. In this approach prices and outputs are explicitly calculated from the demand and supply conditions in each industry. The general equilibrium approach is particularly well suited to analysing the changes in relative costs and prices that will result from changing trade barriers because it fully accounts for the interdependence of all industries. This is especially important when changes in the entire tariff schedule are being considered.

THE GENERAL EQUILIBRIUM APPROACH

When changes in tariffs are substantial, it is usually not wise to analyse the effects one industry at a time. A case for protection may at first seem simple and obvious when considered in isolation, but further investigation will invariably reveal that policies which save jobs in one industry reduce employment and income elsewhere.

An example of this type of interdependence is illustrated by the appeal of the sugar beet growers for higher duties on raw sugar cane made before the Tariff Board in December 1986. It was claimed that 1,400 growers and 383 workers employed in Alberta and Manitoba required a higher tariff on sugar cane to survive. Speaking for the Council of Maritime Premiers, Richard Hatfield argued that the proposed minimum price of 18 cents per pound could raise the cost to consumers by as much as 45 percent and eliminate as many as 1,100 jobs in the sugar refinery and confection industries of the Maritimes. A study of the impact of sugar cane tariffs would be seriously misleading if these effects were not taken into account.

General equilibrium interdependence is not limited to the type of cost price relationships illustrated by the sugar beet growers, where the sugar refineries are wholly dependent on an outside source of supply. A reduction in the tariff may also reduce the cost of domestically produced intermediate goods and thereby the costs of industries which use these goods. The automobile industry, for example, is a significant purchaser of woven goods from the textile industry. By reducing the costs of woven goods we become more competitive in the production of automobiles. General equilibrium effects go beyond these direct relationships. If trade negotiations lead to a higher level of per capita income, demand for all goods rises.

Applied general equilibrium models are designed to bring all such repercussions into account. They are capable of computing the prices of each commodity produced in the country and the output and level of employment in each industry. In addition, they can compute long-run changes in aggregate employment, wage rates and the return to capital. The research reported in this paper was undertaken to implement an applied general equilibrium model of the Canadian economy for the purpose of analysing the effects of changing trade barriers. A complete description of our approach, and comparison to approaches taken by others, will be found in Chapter IV.

ASSUMPTIONS

With the approach taken in this study, there are two types of assumptions. The first has to do with supply and demand: the quantity supplied must at least equal the quantity demanded. The assumption is that, when business firms find that demand exceeds supply, prices will rise, encouraging increased production and reducing demand. When business firms find that supply exceeds demand, they reduce output. The second set of assumptions is concerned with cost-price conditions. It is required that, in equilibrium, revenues must at least cover costs. If costs exceed revenues, it is assumed that the activity in question will not be undertaken.

To be more explicit, the supply and demand conditions refer to the supply and demand of goods, labour, capital and commodities. We distinguish among 92 domestically produced goods which may be sold by one firm to another, to consumers, to government, or to foreigners as part of Canada's exports. Commodity trade refers to Canada's imports from and exports to one of four regions: The United States, Japan, E.E.C. and the Rest of the World (ROW). Basically, it is assumed that Canada must earn enough foreign exchange to pay for her imports and the interest and dividends owed to foreigners net of what foreigners owe to Canada.

The set of cost price constraints refers first of all to conditions of production in 43 industries. Revenue must cover cost. Included in the latter are the costs of purchases from other firms (including foreign firms) and the cost of labour, capital and taxes. Regarding consumers, we assume that they adjust the amounts of domestic and imported goods consumed in a way that maximizes their satisfaction. The amount that they are willing to pay is equal to the price charged by producers plus transportation, wholesale and retail margins and commodity taxes. Similarly, foreigners purchase from Canada in accordance to their willingness to pay. In this case, the amount they are willing to pay must equal the Canadian price expressed in units of foreign exchange plus the tariff charged in the nation receiving our exports.

It should be noted that, except for the explicit assumptions we make regarding changes in the tariff and non-tariff barriers, we do not attempt to explain or predict government behaviour. It is assumed that government's purchases of goods and its budgetary deficit would be the same under free trade as they were under the 1981 tariff. However, under free trade, the budgetary deficit must increase by the amount that tax collections fall short of their 1981 level.

The reader will correctly conclude from this discussion that general equilibrium studies cannot produce predictions of the future. The objective is analysis. First, there is a change in the tariff and other trade barriers. The model is then used to determine the changes in a second set of closely connected variables whose behaviour we claim to understand and which we therefore included in the model for purposes of analysis. Conditions which we believe are inherently unpredictable are assumed not to change and are therefore not part of the model.

On this point, people's judgements and therefore their models will differ. In the previous study by the Economic Council of Canada, Magun et al., (Discussion Paper 331, 344, 1988; hereafter referred to as DP 331 or DP 344), simulation results were obtained through a series of calculations. First, a vector of net exports is calculated under partial equilibrium assumptions, then the Statistics Canada Input Output model and CANDIDE are used sequentially.

The first stage calculation of net exports becomes very influential in determining final outcome. Furthermore, since there is no feedback between the steps, each is based on a different costs and prices. There will be long-run convergence of costs and prices within the CANDIDE stage, but there is no mechanism that will make these costs and prices consistent with the computations external to CANDIDE. The results obtained by Magun (el al., DP 331, 344, 1988) will therefore differ from those obtained from the general equilibrium approach. In the model adopted in this study, costs and prices are determined simultaneously in such a way that supply is equal to demand in all markets. The results we obtain are initiated by a change in costs and prices within Canada and between Canada and the other nations.

On the other hand, the CANDIDE model includes aspects which we have chosen to exclude. Financial markets, the behaviour of the public sector and private investors' decisions are fully specified. Through CANDIDE, one can follow the economy through its stages of moving from one level of capital formation to another. The process of building new capital for the period following the bilateral agreement is a source of demand that is omitted from our calculations. It is assmued that the net increase in Canadian capital stock is aquired from abroad. To the extent that Capital is imported, Canadian production potential is greater but greater dividends must annually be paid to foreigners. The levels of output (and other variables) shown in our tables represent the relationships that would prevail after the capital required has been built.

THE "ELASTICITY" QUESTION

In the model, the behaviour of nations other than Canada is expressed by demand curves for Canadian goods. These are given a standard mathematical form which is discussed in our later chapters. The key parameter in these equations is a number (the elasticity of demand) which expresses the response of the foreign buyer to a change in the cost (in his own currency) of goods imported from Canada. All attempts to estimate the effects of tariff negotiations (whether of the partial or general equilibrium type) must rely on such estimates. The most sophisticated and extensive research on this topic has been produced by Deardorff and Stern and their associates at the University of Michigan. In our model, we have relied heavily on their latest work (Shields, Stern and Deardorff, 1986) and data supplied by the Economic Council of Canada. Unfortunately, work published by these authors and others indicates that there may be a substantial deviation of the estimated from the actual elasticities. Theoretical considerations have led experts in this area to regard the estimated elasticities as too low. The matter has been under discussion in the literature since the fifties (Orcutt,1950; Machlup, 1950) and continues to be of interest (Kemp, 1962; Detomash, 1969; Kakwani, 1972; Mansur, 1982).

The problem results in part from aggregation of data. Published data are organized into general classifications; the fewer the number of classes the lower the estimated elasticity (as compared to a weighted average of the "true" elasticities). The elasticity measures the percentage by which people in, say, the United States, will increase imports when the price of Canadian goods (in US dollars) falls by one percent (because of the lower US tariff). For instance, the percentage amount of increase for ladies' shoes will be greater than the increases obtained for a general category such as leather products. Because disaggregated data are not available, estimates are based on aggregated data which show lower elasticities.

There is a second problem of equal or greater importance. The elasticities estimated by Shields, Stern and Deardorff (1986) measure the amount by which a reduction in the US tariff leads Americans to substitute imported goods from all nations for domestic goods. If we merely use the Canadian share of this

TABLE 1

Factors Causing Changes in Canadian Output under Bilateral Free Trade

		Factors Favouring Output Expansion				Factors Forcing Adjustment		
	Name of Industry	Lower US Tariff (1)	US Gov't Buys More From Canada (2)	Lower US NTBs (3)	Average Cost Dis-advantage (4)	Lower Canadian Tariff (5)	Canadian Gov't Buys More from US (6)	Lower Canadian NTBs (7)
		(%)	($1000)	(%)	(%)	(%)	($1000)	(%)
1.	Agriculture	2.24	14	0.66	0	2.22	22	0.64
2.	Forestry	0.25	1	0.05	0	0.05	2	0.00
3.	Fishing, Hunting & Trapping	1.37	0	0.00	0	0.19	0	0.00
4.	Metal Mines	0.19	111	0.00	0	0.06	286	0.00
5.	Mineral Fuels	0.30	464	0.00	0	0.42	1,666	0.00
6.	Non-Metal Mines & Quarries	0.05	16	0.00	0	0.51	573	0.00
7.	Services Incidental to Mining	0.14	100	0.00	0	0.07	257	0.00
8.	Food & Beverage Industries	3.53	1,280	0.75	4.16	4.23	2,005	2.07
9.	Tobacco Products Industries	10.13	7	0.00	0	16.05	2	0.00
10.	Rubber & Plastics Products Ind	6.74	542	0.00	1.15	8.84	915	0.00
11.	Leather Industries	8.09	49	0.00	3.28	12.28	8	0.00
12.	Textile Industries	7.33	940	0.00	3.5	9.03	311	0.01
13.	Knitting Mills	12.66	3	0.00	2.24	21.48	5	0.00
14.	Clothing Industries	10.79	304	0.00	2.75	17.21	471	0.00
15.	Wood Industries	1.45	1,205	8.93	3.49	2.74	970	0.00
16.	Furniture & Fixture Industries	3.01	2,828	0.00	3.73	12.69	2,309	0.00
17.	Paper & Allied Industries	0.93	2,974	0.00	6.73	4.02	1,718	0.00
18.	Printing & Publishing	0.58	192	0.00	5.08	1.42	53	0.00
19.	Primary Metal Industries	2.21	537	4.16	1.03	4.07	1,610	0.00
20.	Metal Fabricating Industries	3.24	4,397	0.37	3.79	6.85	7,313	0.02
21.	Machinery Industries	2.55	17,295	0.04	2.5	4.73	34,777	0.00
22.	Transportation Equipment Ind.	0.56	7,729	0.00	5.1	2.35	8,790	0.23
23.	Electrical Products Industries	3.73	12,199	0.00	6.94	6.17	8,352	0.00
24.	Non-Metallic Mineral Prod Ind	2.95	452	0.00	5.53	3.50	21,678	0.00
25.	Petroleum & Coal Products Ind	0.44	1,017	0.00	1	0.63	3,191	0.00
26.	Chemical & Chemical Prod Ind	2.34	336	0.00	2.15	5.72	408	0.00
27.	Misc Manufacturing Industries	3.56	45,507	0.00	6.6	6.26	6,669	0.00
28.	Construction Industry	0.00	0	0.00	0	0.00	0	0.00
29.	Transportation & Storage	0.03	136	0.00	0	0.10	350	0.00
30.	Communication	0.14	332	0.00	0	0.24	371	0.00
31.	Elec Power, Gas, & Other Ind	0.00	0	0.00	0	0.00	1	0.00
32.	Wholesale Trade	0.10	1,343	0.00	0	0.17	965	0.00
33.	Retail Trade	0.03	14	0.00	0	0.05	21	0.00

*Very small entries are rounded to zero and displayed as 0 or .00.

increase to predict export sales, it will seriously understate the actual amount. Under bilateral free trade, the US tariffs which apply to imports from other nations of the world are unchanged. Americans will buy more Canadian goods and less of both their own domestic goods and of goods produced in all nations in the world except Canada.

Indirect evidence suggests that the elasticities in manufacturing will be much larger than those estimated by Shields, Stern and Deardorff (1986). Here we refer to empirical evidence indicating the presence of economies of scale at the level of the firm. In that part of Canadian manufacturing dominated by multinationals, reduced costs are possible if individual establishments become more specialized. To make such a system work, the Canadian plant must produce far more of some models and sizes than can be sold in Canada. The excess would be exported to the United States and sold for the prices in the US that are presently considered optimal. By implication, the plant would give up producing all the variety that is demanded by the Canadian consumer. This demand would be met from US imports. This was the pattern of change which we observed under the 1965 Automobile Agreement.

The relevant point as far as this study is concerned is that, by implication, the elasticities involved are very large (mathematically speaking, they are infinite). Little or no change in the American selling price is needed to obtain a

Expansionary Forces

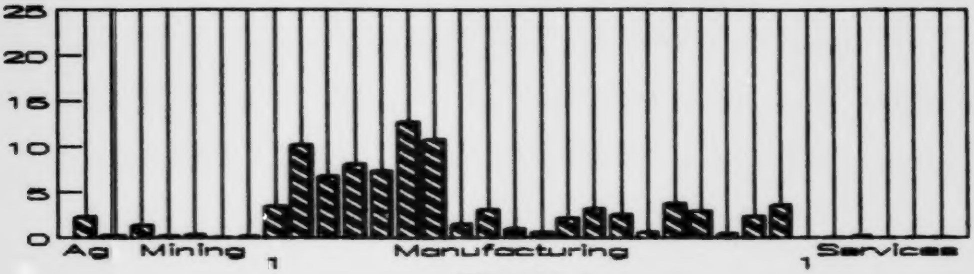

Lower US Tariffs

Figure 1

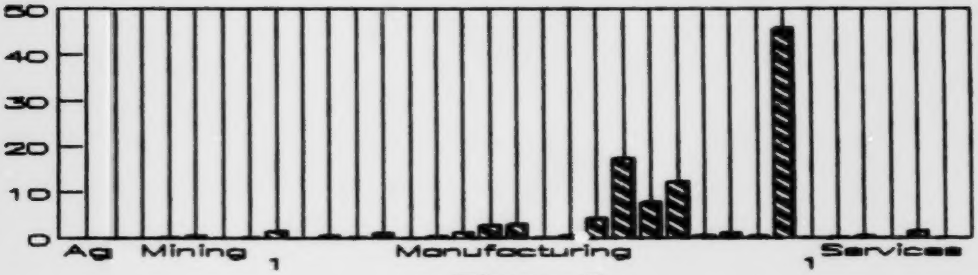

More US Gov't Purchases

Figure 2

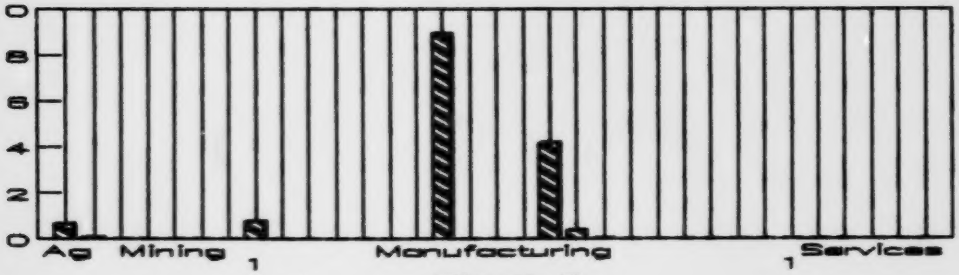

Lower US NTBs

Figure 3

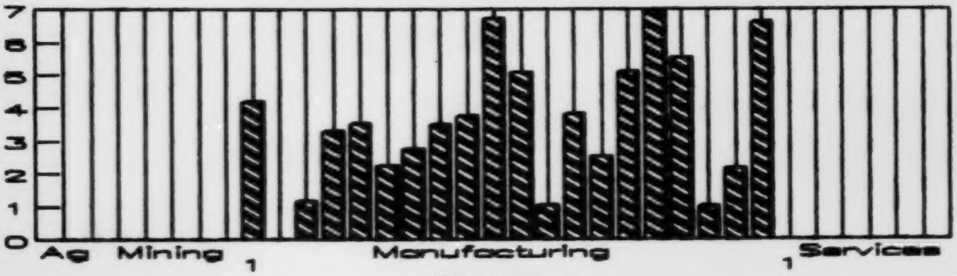

Average Cost Disadvantage

Figure 4

substantial increase in Canadian export sales. Many observers claim that the competitive forces that have generated this type of economy in the United States will bring a similar type of specialization to Canada even in those firms which are not multinationals. If this is the case, we obviously should be using elasticities for the manufacturing sector which are much larger than those estimated. Elasticity estimates are necessarily based on historical data and history has never shown us an example of Canadian-US free trade.

Unfortunately, the elasticity question will not be resolved in the near future and we are unable to base our analysis on either the assumption that the elasticities are low as implied by the empirical studies, or as high as would be suggested by indirect evidence and theory. Accordingly, the analysis below examines the implications of both. In the scenarios we call low elasticities, it is assumed that the elasticities take on the estimated values. In the scenario we call high elasticities, we at first gave consideration to the so-called "small nation assumption" - that Canada could sell in the US market without reducing price (in American dollars) at all. In the end we adopted a more moderate form. In the high elasticity case it is assumed that manufacturing elasticities are at least 10 - a fall in the US tariff of one percent is assumed to increase Canadian exports to the US by at least by ten percent. This is achieved by increasing the estimated elasticity in all manufacturing categories by 10.

FACTORS LEADING TO ECONOMY-WIDE CHANGES

The Canadian-US bilateral free trade agreement (hereafter to be called the agreement) is a comprehensive package. Many aspects of it are concerned with important non-economic factors. These non-quantitative matters are discussed in the Council's earlier studies (Magun, et al., DP 331, 1988) and in the Council's statement (Economic Council, Ec22-151, 1988a). This study is restricted to those aspects of the agreement that can be quantified in economic terms. The presentation below begins with a discussion of the factors which will lead to change.

Figures 1 - 4 show those factors of the agreement that lead to expansion of Canadian output and employment. In each, there are 33 vertical lines, one for each of the 33 industries whose names appear in Table 1. There are, in fact, 43 industrial classifications considered in this study but none of the quantitative factors that cause economy-wide changes directly affect industries 34 - 43 (which are all service industries). The service industries are affected indirectly by changes in tariffs, NTBs and government procurement but the direct effects are nil and are therefore omitted from Table 1 and from Figures 1-9. We will add them to our later tables and figures if it becomes relevant to do so. The exact amounts shown on the axes in Figures 1-9 are found in Table 1.

From Figure 1, one receives a general impression of the relative effect of the lower US tariff under bilateral free trade. Actually, the tariff paid depends on the commodity being exported, not the industry where it was produced and therefore it is not quite correct to speak of an industry's tariff. However, to give a general impression, we have computed a weighted average tariff for each industry. The tariff on each commodity counts in proportion to its value in that industry's 1981 output. It can be seen that these weighted average US tariffs are highest in manufacturing, especially in the early stages which include mostly textiles (10 - 14), but also in tobacco products (9). Tariffs in this range run 6 - 12 percent whereas in other manufacturing industries they are found in the 1 - 4 range. Tariffs on commodities in the services are nearly nil. If US tariffs were the only factor leading to change, we would expect that industries 9 - 14 of the manufacturing sector would expand the most under bilateral free trade with lesser increases in all other industries except services. However, the agreement involves much more than the US tariff.

Each nation has agreed to liberalize its rules regarding government procurement. There are provisions which allow Canadian firms to bid for sales to the US government on the same terms as American firms. Unfortunately, in the final agreement, defence, transport and telecommunications goods were excluded. This greatly reduces the expansionary impact as far as Canadian exports are concerned. The Council's estimates of increased exports due to the liberalization of government procurement rules in the US are given by commodity classification in Table 7 of Magun et al., (DP 344, 1988). To give the reader a general impression we have converted the Council's figures to an industry basis. For the purpose of Figure 2, each industry is assumed to share in the expansion of export sales to the US in proportion to its production of each commodity. The reader will observe that, as with the US tariff, the expansionary effect is greatest in manufacturing. It is nearly non-existent in agriculture, mining and services. The concentration within the manufacturing sector is in the later stages of processing - industries 20 through 23, metals, machinery, transportation and electrical. The greatest impact falls on the commodities produced by the Misc. Manufacturing Industries (27). Industries in this classification produce goods which are referred to as "end-stage" commodities because they require little or no further processing.

Figure 3 shows the relative impact of the third factor leading to expansion of Canadian output. Non-tariff barriers (hereafter NTBs) are restrictions to trade which do not involve tariffs. They take many forms. The nations of destination may require the exporting nation to restrain exports to some agreed-upon level, or standards may be imposed for the sole purpose of excluding imports from some particular

Contractionary Forces

Lower Canadian Tariffs

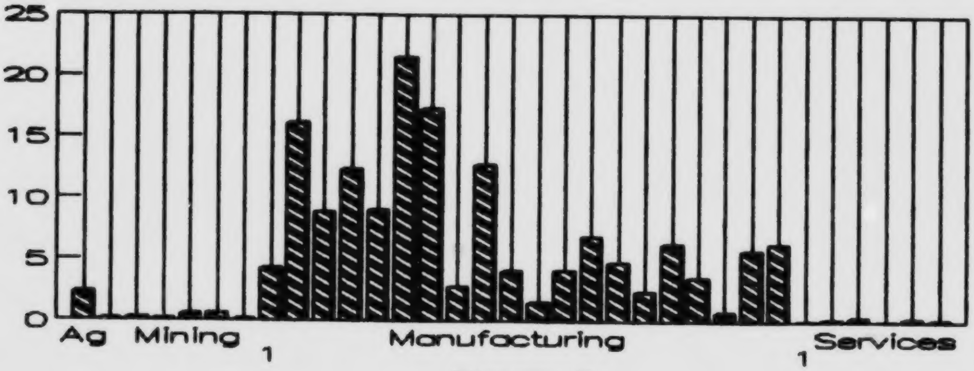


Figure 5

More Imports Purchased By the Canadian Government

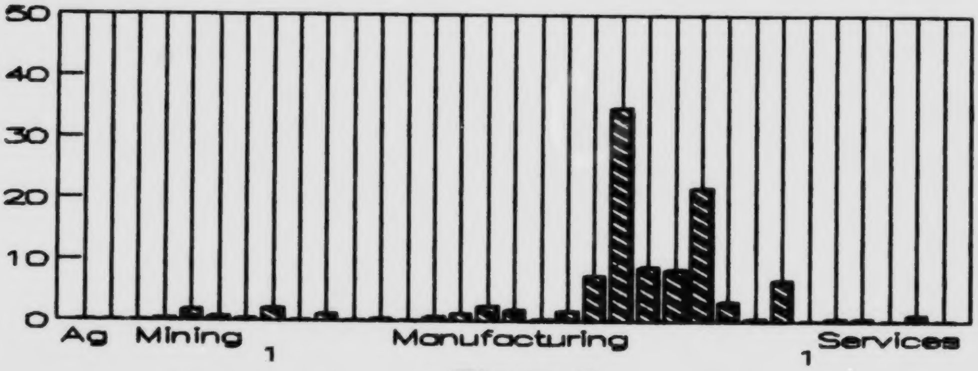


Figure 6

Lower Canadian NTBs

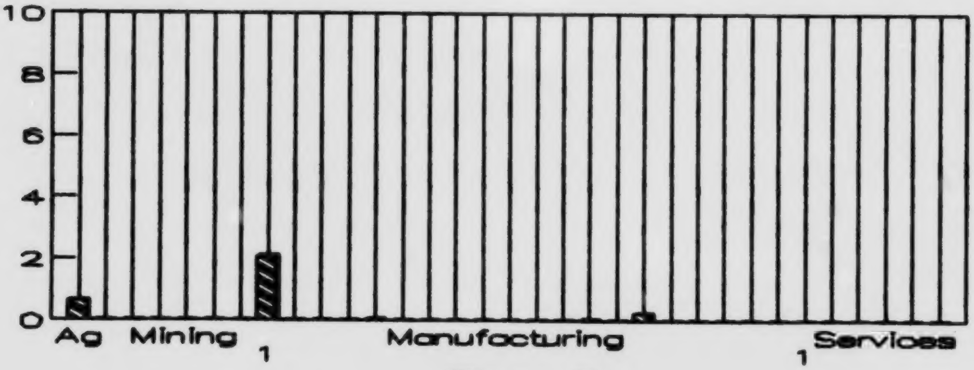


Figure 7

source. The Council gives us a rough assessment of the quantitative effect of NTBs. These are expressed in terms of "tariff equivalents" - the amount of tariff which, if it replaced the NTB, would restrict imports by the same amount. It was not possible to find tariff equivalents for everything and the Council therefore restricted itself to consideration of "contingency protection, voluntary export restraints, quotas, prohibition (health and safety standards), import licensing and discretionary customs valuations." The estimates are shown by industry in Table 5 of Magun et al., (DP 344, 1988) and are reproduced in our Table 1. From Figure 3, the reader can see that the NTBs are concentrated in only a few industries, mostly in manufacturing. The Wood Industries (15) and Primary Metals (19) stand out in this regard.

The final factor leading to export expansion is, perhaps, as important as the other three taken together. Studies since the late sixties (Eastman and Stykolt, 1967; Wonnacott and Wonnacott, 1967 and Daly et al., 1968) have shown that a US advantage in the cost of manufacturing could be explained by the degree of specialization at the level of the firm. In Canada, production runs were short: firms were producing too many models, colours and sizes. Production runs in the US were longer: an American firm producing the same product as a Canadian one would be more specialized. The greater amount of specialization in production was possible in the United States because of its larger open market. With bilateral free trade, Canadian firms should be able to reach the same levels of cost efficiency as are observed in the United States.

Estimates of the cost disadvantage (by industry) due to the smaller market in Canada are found in Robidoux and Lester (1988) and reprinted in Table 8 of Magun et al., (DP 344, 1988). They are again reproduced in our Table 1. (See also Lester and Letourneau 1988.) This "disadvantage" represents the percentage by which the average cost in one of the Canadian industries can be reduced under bilateral free trade due to specialization within the production establishment at the level of the firm. These gains are not related to the output levels of the industry or even to the output of the firm itself. Expanded production of one line replaces output of some other related product leaving total output unchanged. The actual data suggested that the cost disadvantage was twice as large as that shown in Table 1 and Figure 4. But estimates necessarily come from older data and the Council advised that we assume that trade liberalization preceding the bilateral agreement between the US and Canada had eliminated one-half of the cost disadvantage estimated from the older data. The cost disadvantages that will be eliminated through free trade are all concentrated in manufacturing.

The reader will note from Figures 1 through 4 that none of the factors leading to expansion of Canadian output concentrate in any particular industry but, in general, there are more incentives for manufacturing to expand than there are for

TABLE 2

Effects of the Anticipated and Actual Free Trade Agreement on Three Key Variables

ASSUMPTIONS:	(1)	(2)	(3)	(4)	(5)	(6)
Tariffs Removed	x	x	x	x	x	x
Scale Economies Present		x		x	x	x
Export Elasticities High			x	x		x
NTBs Reduced					x	x
Bias In Government Purchases Relaxed					x	x
INDICATOR:						
Consumption	-0.53%	0.20%	0.56%	4.15%	0.34%	5.27%
Labour Requirements(a)	0.19%	0.09%	0.63%	1.64%	0.16%	2.07%
Real Wage(b)	0.63%	0.30%	2.10%	5.56%	0.55%	7.07%

(a) Labour requirements represent an aggregation of skill groups. Each group counts in proportion to wages paid in 1981.

(b) The average hourly wage - the amount of consumer satisfaction that can be be purchased with one hour's work. Each skill group is weighted by its 1981 share in total labour supply.

agriculture, mining, or services. However, the offsetting factor leading to contraction of output are also concentrated in manufacturing.

Figure 5 shows the distribution of the Canadian tariff by industry. Canadian tariffs are higher than those of the US but the pattern is nearly the same. The highest Canadian tariffs are found in the tobacco and textile industries (9 through 14) falling between 8 and 21 percent. In the remainder of manufacturing, tariffs fall in the range 1 - 6 percent. Tariffs on manufactured goods are higher than those in agriculture or mining and are more or less non-existent in the service industries.

Canadian government procurement restrictions are shown in Figure 5 and in detail in Table 1. As with the US government procurement, we have converted the Council's figures from a commodity basis to an industry basis. For the purpose of Figure 8, each industry is assumed to share in the expansion of export sales to the US in proportion to its production of each commodity in 1981. The concentration is similar to that for the US shown in Figure 2 but the distribution within that concentration is different. The greatest protection is in the Machinery Industries (21) and in the Non-Metallic Mineral Products Industries (23). The largest, found in the Food and Beverage Industries (8), is only two percent.

Canadian NTBs are smaller than those of the US but, as can be seen by comparing Figure 7 to Figure 3, both the US NTBs and the Canadian ones are focussed in a few industries. The Canadian level is greatest in the Food and Beverage industry (8) but is equivalent to only 2 percent.

In this study, the objective is to determine the impact of the seven factors shown in figures 1-7 on such matters as output, employment and the standard of living. It becomes clear from inspection of Figures 1 through 7 that they all point in different directions - some encourage expansion of one or another particular industry while others suggest contraction of the same industry. For most, the impact is on costs and prices but the impact of government procurement is directly on output.

EFFECTS OF BILATERAL FREE TRADE ON THREE KEY INDICATORS

For analysis, six experiments were defined in terms of the conditions described in the first five lines of Table 2. In all six experiments it was assumed that tariffs would be removed in accordance with the final stage of the agreement. Experiments differ because we assume that elasticities are high rather than low, or that economies of scale are present or absent. In some experiments it is assumed that there are no changes in NTBs and in others that rules concerning government procurement are left out of the final agreement. The six experiments are evaluated in terms of the indicators listed at the bottom of Table 2. Consumption in this table measures the level of satisfaction or utility. The list of goods actually consumed in 1981 is arbitrarily assigned a value of unity. Similarly, the real wage measures the value of a unit of work in terms of 1981 consumer satisfaction. It is also assigned a 1981 value of unity. Labour requirements in Table 2 refer to an index of employment. In this index jobs count in proportion to their importance as measured by the 1981 wage in each occupation. Percentage changes in the three key indicators under the various scenarios are shown in the columns to the right.

Column 6 of Table 2 shows the high elasticities scenario. It indicates that the increase in consumption will be 5.3 percent, that labour requirements will increase 2 percent and that the real wage will increase 7 percent. (The rise in the real wage by more than the increase in consumption is possible because the return on property income falls.)

The reader will note that scenarios 4 and 6 yield significantly greater benefits than do any of the other four. They are also the only two scenarios in which we incorporate both the high elasticity assumption and the estimated firm level economies of scale. These two assumptions seem to be necessary if Canada is to make significant gains. In scenario 5 the export elasticities are assumed to be low and this is the only way it differs from 6. In scenario 5 all the indicators are less than one percent.

Actually, the importance of the high elasticity and scale assumption is made clear from a comparison of scenarios 1 through 4. Scenario 1 reports the change when the agreement is limited to tariff reductions, elasticities are low and there are no scale economies present. Consumption falls by about one-half percent. With scale economies present (scenario 2), there is an increase in consumption but it is less than one-half percent. If we assume high elasticities but no scale economies (scenario 3), the improvement is greater but still only slightly greater than one-half percent. However, with high elasticities and scale economies present, consumption rises by 4.15 percent. The data lead us to conclude that significant gains from bilateral free trade are to be expected only if (1) economies through firm level specialization are of the order and magnitude of those shown in Table 2, and (2) if specialized products produced in Canadian plants can be sold in the United States at a US price which is only slightly lower than at present. If these two assumptions are valid, then scenario 6 best describes the implied gains; a considerable proportion of this and the next two chapters are committed to a full description of the

TABLE 3

Changes in National Aggregates

	Reference Year 1981 (Billions) (1)	Elasticities: Low (2)	Elasticities: High (3)
G. N. E.(a)(b)	344.78	0.26%	4.01%
Consumption (b)	196.67	0.35%	5.30%
Domestic Production	165.95	0.38%	4.68%
Imports	30.72	0.20%	8.61%
Exports(b)			
to US	58.75	8.84%	18.58%
to ROW	29.03	4.55%	-8.38%
Total(c)	87.78	7.42%	9.67%
Imports(b)(d)			
intermediate Goods			
from US	35.87	3.36%	6.45%
from ROW	17.62	2.33%	4.93%
Total	53.49	3.02%	5.95%
Consumer Goods			
from US	12.10	1.49%	10.47%
from ROW	7.74	-2.26%	5.67%
Total	19.84	0.03%	8.60%
Total(d)	73.34	2.21%	6.66%
Trade Surplus(Billions)	1.58	0.67	-2.47
Currency Conversion(e)	1	1.68%	-2.97%
Terms of Trade	1	-4.02%	0.61%
Real Wage	1	0.55%	7.07%
Labour Requirements(f)	195.96	0.16%	2.07%
Indirect Taxes	39.74	-2.93%	0.47%

(a) Excludes 5.8 billion of property income generated the Household and Government Sectors.

(b) In 1981 purchasing power.

(c) Excludes 5.38 of "unallocated" exports. See the Input-Output Structure of the Canadian Economy (15-201, Statistics Canada).

(d) Excludes imports for use of government, capital formation and inventories valued at 19.45 billion in 1981.

(e) The exchange rate that will leave the Current Account unchange.

(f) Labour requirements represent an aggregation of skill groups. Each counts in proportion to 1981 wages paid.

implied changes in imports, exports, output, employment and costs.

If assumptions 1 and 2 of the preceding paragraph are not valid, the agreement will not bring significant improvements. The results are best represented by scenario 5 of Table 2. All measures of improvement increase but none by more than one-half of one percent. In scenario 1, there is actually a decline in living standards but this represents one of the cases in which we assume that the agreement is limited to tariff reductions. Since this case does not include all of the provisions of the actual agreement, the low elasticities case (Scenario 5) must be regarded as the worst possible outcome. If this is so, Canada cannot become worse off under the agreement.

NATIONAL AGGREGATES

A somewhat more detailed picture of the national economy is presented in Table 3 where we have listed the values of Gross National Product (GNE), Consumption of domestic production, Exports, Imports, the Balance of Trade Surplus, Labour Requirements and Indirect Tax collections. All values are measured in real terms. Exports and imports are broken down by area of destination or source: the United States (US) or the Rest of the World (ROW). Certain key prices are also presented: the Currency Conversion Factor, the Terms of Trade and the Real Wage.

It is the function of the exchange rate in the national economy to balance supply and demand for currency in financial markets. The demand for foreign exchange includes that needed to purchase foreign bonds, stocks and real property in foreign nations. The supply includes the demand on the part of foreigners for Canadian bonds, stocks or real property. The net amount of these two is usually referred to as the Capital Account of the Balance of Payments. In addition there are the supply and demand requirements of the Bank of Canada when it intervenes in the market for foreign exchange in order to influence the level of the exchange rate. As noted above, these are matters which we assume are unpredictable and which we therefore take as constant. The amounts required for the Capital Account and by the Bank of Canada are assumed to be equal to the demands observed in 1981. In the model, variations in the supply and demand for foreign exchange result from variation in the Current Account.

The Current Account also represents a balance of demand and supply. On the demand side there is the amount of foreign exchange needed to purchase foreign goods or services plus the amount needed to pay dividends and interest to foreigners who own Canadian bonds, stocks or real property. On the supply side there is the amount of foreign exchange offered to purchase Canadian dollars for the purpose of buying Canadian goods and services or for transferring dividend and interest to Canadians. In all scenarios, it is required that Canada earn a surplus on the Current Account at least equal to its 1981 surplus. The exchange rate that achieves this is called the currency conversion factor. The currency conversion factor increases in the high elasticities case by 3 percent. In the low elasticities case it falls by 1.7. This represents an appreciation of the Canadian dollar in the high elasticities case and depreciation in the low elasticities case.

The terms of trade summarize the changes that take place in the currency conversion factor and in prices of imports and exports. It is, in fact, the ratio of two price indices expressed in Canadian dollars. The numerator of the ratio is an index of the prices (in Canadian currency) received for exports. To compute this index for any scenario, we use the reference period commodity exports as weights. A rise in export prices will cause the terms of trade to increase. The price index in the denominator is an index of the prices paid for imports. These prices are converted to Canadian currency using (the inverse of) the currency conversion factor and are weighted using the reference period commodity imports. An increase in import prices (expressed in the foreign currency) or increase in the currency conversion factor (decrease in the value of the Canadian dollar) will cause the terms of trade to fall. From Table 3, the reader can verify that the terms of trade and currency conversion factor move in opposite directions. With low elasticities assumed, the terms of trade fall by 4 percent but rise .61 percent when high elasticities are assumed.

Consumption, the real wage and labour requirements were discussed in the previous section. The conclusion reached in that section will also apply to Gross National Expenditure (GNE) shown on line 1 of Table 3. GNE increases in all scenarios but significant increases (of about 4 percent) occur only in the scenarios in which economies of scale are present and high elasticities assumed.

Total exports increase whether we assume low or high elasticities. Under the high elasticities assumption, the amount of increase is 9.67 percent and 7.4 percent under the low elasticities assumption. The 9.67 percent expansion under the high elasticities assumption is achieved through a 18.6 percent increase in exports to the US accompanied by a 8.4 percent decline in exports to the ROW. Exports to the US are encouraged by the reduced tariffs and other measures under the bilateral agreement, but the improvement in Canada's terms of trade dampens the increase by increasing the US dollar cost of Canadian exports. The rise in Canada's terms of trade leads nations in the rest of the world to buy less from Canada than was purchased before the agreement. In the low elasticities case there are increases to both US (8.84 percent) and to the ROW (4.55 percent). In this case, exports to the ROW are stimulated by a fall in Canada's terms of trade.

The changes in imports are similar. We find expansion is greater in the high elasticities scenario (6.66 percent) and lower in the low elasticities scenario (2.21 percent). This is true for both intermediate goods (5.95 under high elasticities; 3.02 under low elasticities) and final goods (8.60 under high elasticities; .03 under low elasticities). Imports from the United States are encouraged by Canada's high level of GNE and, in the high elasticities case, by the rise in Canada's terms of trade which makes foreign goods cheaper. Under the low elasticities scenario, imports from the rest of the world are less than in the reference period because of the increased cost of foreign goods when Canada's terms of trade rise.

The last line of Table 3 shows the changes in indirect taxes. Under bilateral free trade, Canada loses the amount of indirect taxes previously collected on goods imported from the United States. These are recouped, in the high elasticities case, through duties paid on the increased amount of goods imported from the ROW and from increased indirect taxes paid by industries which expand under the agreement. There are gains of indirect taxes in the high elasticities scenario of about .5 percent, but in the low elasticities case the imports from ROW decline and indirect taxes fall off by nearly 3 percent.

CONCLUSION

The bilateral agreement with the United States will increase Canada's standard of living. Our results indicate that the amount of increase will vary between .5 to 4.2 percent. This conclusion is in general agreement with the .7 to 3.3. range obtained in other studies. Two key assumptions are necessary to obtain the higher figure. Plant level economies of scale must be present and Canadian products must be accepted in the North American market at prices (in US currency) near those currently charged for similar US goods. This conclusion agrees with the earlier study of Harris and Cox (1983) and the more recent study of the Department of Finance (1988). Our lower figure indicating gains of only .5 percent is approximately that obtained by Hamilton and Whalley (1985) who do not incorporate an economies of scale assumption. In a model similar to that of Harris and Cox (1983) published by the Department of Finance (1988) gains of only 2.5 are reported. The Department of Finance (1988) estimate uses a more optimistic estimate of scale economies (by about 25 percent) but less optimistic assumptions regarding the elasticities. Perhaps it is reasonable to take the range 2.5 - 4.0 percent as a reasonable expectation for the economic gains.

Most general equilibrium studies take the quantity of labour supplied as constant. We may. however, compare the our results indicating an increase of 2 percent in labour requirements to those reported in the recent study of the Economic Council of Canada DP 344. With economies of scale present at a level also assumed by us but with elasticities which are lower, the DP 344 study indicates an increase in employment of 2.3 percent which is similar to our figure of 2.07 in scenario 6. The DP 344 estimate of the change in the real wages of 2.3 percent, however, is considerably less than our figure of 7.1. This higher percentage in our study is explained by the more optimistic assumption concerning the export elasticities which gives us a higher growth in consumption and GNE, and to a decline in the return on income from property of about 3 percent. If correct, the benefits to labour would be significantly greater than previously estimated in DP 344 leading to an increase in the wages paid of as much as 11 percent (1.02 x 1.07 = 1.11).

CHAPTER II

CHANGES IN THE LEVEL OF OUTPUT AND EMPLOYMENT

In the previous chapter we confined our attention to certain key indicators. In the sections of this chapter we shall look at the changes behind those summarized in Table 3 in more detail. As the amount of detail increases so also does the amount of data which must be presented. In order to make the presentation palatable, the data are presented in the form of figures and tables. The figures will give an overall impression, but from many of them the reader will not be able to read data relating to any particular industry; for that purpose it will be necessary to consult the associated table. Because of the amount of detail involved, we shall report on only two of the the scenarios discussed in Chapter I - the low and high elasticity cases involving all features of the actual agreement.

Details on changes in industrial output are found in Table 4. The percentage changes are shown in Figure 8. Labeling along the abscissa in many of the figures following will be the same

TABLE 4

Percentage Changes in Output by Industry under Various Scenarios

Industry	Reference Year 1981 (1)	Elasticities: High (2)	Elasticities: Low (3)
	(000)	Percent	Percent
1. Agriculture	1,870	4.32%	1.48%
2. Forestry	458	20.06%	4.68%
3. Fishing, Hunting & Trapping	93	5.44%	1.59%
4. Metal Mines	711	0.25%	2.12%
5. Mineral Fuels	1,911	7.61%	6.83%
6. Non-Metal Mines & Quarries	240	-6.24%	-1.32%
7. Services Incidental to Mining	374	1.82%	1.33%
8. Food & Beverage Industries	3,250	8.22%	1.70%
9. Tobacco Products Industries	144	5.24%	0.36%
10. Rubber & Plastics Products Ind	478	11.44%	3.88%
11. Leather Industries	125	10.24%	3.59%
12. Textile Industries	519	10.11%	3.47%
13. Knitting Mills	95	0.33%	0.27%
14. Clothing Industries	422	10.01%	2.36%
15. Wood Industries	853	32.14%	3.24%
16. Furniture & Fixture Industries	282	1.81%	10.35%
17. Paper & Allied Industries	1,601	1.38%	7.71%
18. Printing & Publishing	657	4.19%	2.29%
19. Primary Metal Industries	1,800	12.21%	5.97%
20. Metal Fabricating Industries	1,272	1.65%	3.06%
21. Machinery Industries	920	-0.03%	7.72%
22. Transportation Equipment Ind	2,282	9.16%	3.66%
23. Electrical Products Industries	967	17.15%	5.75%
24. Non-Metallic Mineral Prod Ind	489	7.56%	2.89%
25. Petroleum & Coal Products Ind	2,079	3.01%	1.00%
26. Chemical & Chemical Prod Ind	1,381	1.02%	9.25%
27. Misc Manufacturing Industries	435	18.17%	6.87%
28. Construction Industry	5,795	0.77%	0.18%
29. Transportation & Storage	2,802	2.45%	1.51%
30. Communication	1,112	3.20%	0.87%
31. Elec Power, Gas, & Other Ind	1,169	4.63%	1.28%
32. Wholesale Trade	2,232	2.17%	0.91%
33. Retail Trade	2,856	5.74%	1.23%
34. Owner Occupied Dwellings	2,108	7.01%	-0.70%
35. Finance, Ins. & Real Estate	4,433	4.05%	1.15%
36. Education & Health Services	819	2.06%	-0.26%
37. Amusement & Recreation	325	5.21%	-0.29%
38. Serv to Business Management	1,610	2.37%	1.32%
39. Accommodation & Food Serv	1,383	3.61%	0.41%
40. Other Personal & Misc. Serv	412	2.29%	-0.09%
41. Transportation Margins	1,094	2.18%	2.10%
42. Operating, Office, Lab & Food	1,881	5.06%	2.33%
43. Travel, Advertising; Promotion	1,168	4.27%	1.97%

Percentage Changes in Industry Output:

High vs Low Elasticities

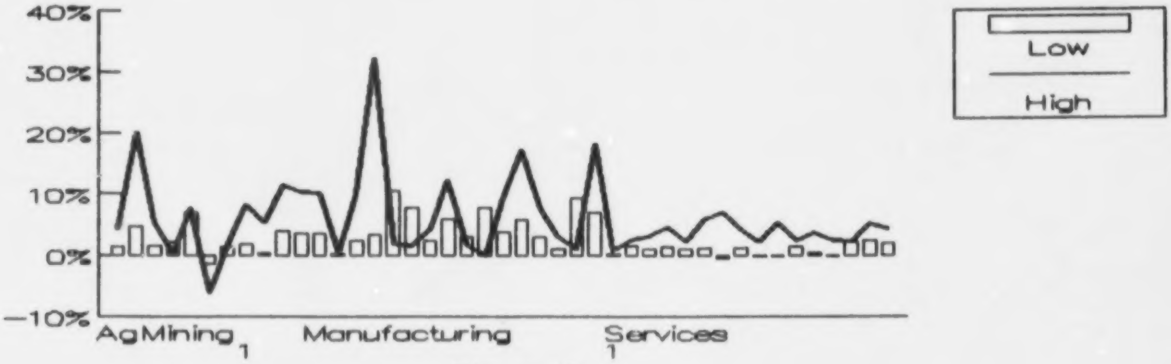


Figure 8

Industry Output

Low Elasticities vs Reference

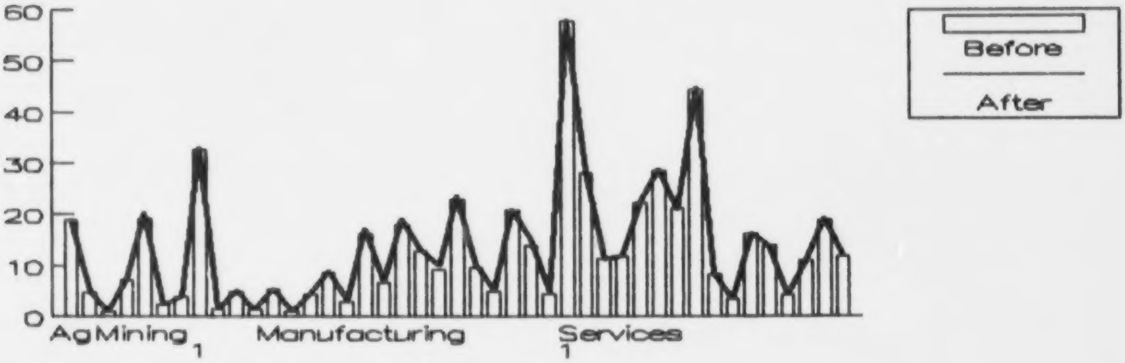


Figure 9

High Elasticities vs Reference

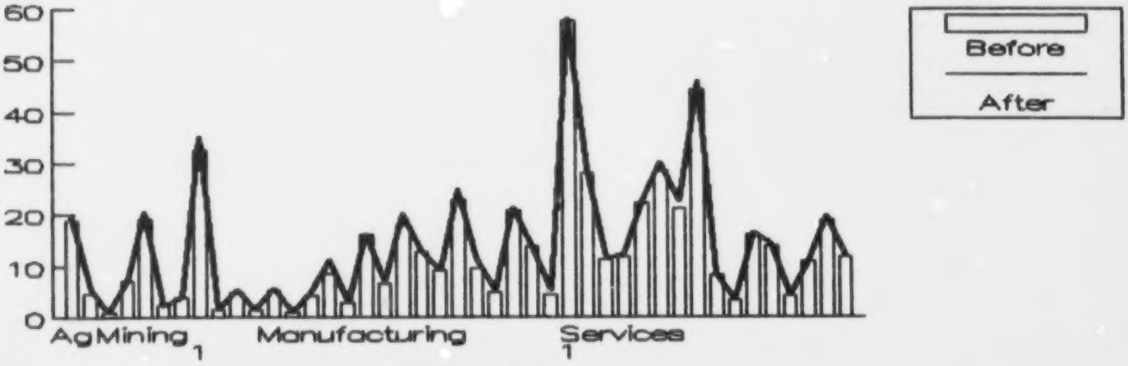


Figure 10

as in Figure 8. Industry 1 is Agriculture, industry 2 is Forestry and 3 is Fishing, Hunting and Trapping. These appear above the letters Ag to the left of the word Mining in Figure 8. The mining industries 4-7, manufacturing 8-27 and service industries 28-43 are above the places indicated in the figure.

CHANGES IN OUTPUT BY INDUSTRY

Under the low elasticities assumption, there is a very small increase in GNE. This and the growth of exports induced by the fall in Canada's terms of trade stimulate a uniform expansion of output in all industries. The growth is greatest in the manufacturing sector because prices fall relatively more in these industries due to economies of scale and because US trade barriers, prior to the agreement, are greatest in this sector. Sales within Canada and exports both expand.

The expansion of demand is even greater in the high elasticity case - particularly export demand (see Figure 21 in Chapter III). Because, in this case, the terms of trade improve, there is a shift of Canadian demand away from imports onto domestic goods. Demand for domestic goods is stimulated further by a significant improvement (compared to the low elasticity scenario) in national income (see Figure 40 of Chapter IV).

There are only two industries where decline is indicated. The amount of decline in the Machinery Industries (21) is only .03 percent. If the reader will refer back to Table 1 and Figure 6 of Chapter I, he will find that there is no classification receiving as much favour through Canadian government purchasing bias as does the Machinery Industries (21) group. Exports of machinery increase but imports increase even more and although there is a very small increase (.02 percent) in domestic sales, Canadian production declines because the government buys less.

The decline of 6 percent in Non-Metal Mines & Quarries (6) production is due to a decline in export sales. The US tariff on Canadian exports is only .05 percent. Under bilateral free trade, the the terms of trade improve by .61 percent so that the US price actually increases leading to reduced sales in that market as well as in the Rest of the World.

Although the pattern of change under the high and low elasticities assumptions differs, the difference is not so great as actually to change the relative sizes of Canadian industries. This is clear from inspection of Figures 9 and 10. These two figures compare the output after the agreement to the level as it was in 1981. Output by industry before the agreement is shown by the dark line. In Figure 9 the bars show output by industry under the low elasticities assumption and Figure 10 under the high elasticities assumption. The bars in both figures have nearly the same pattern as the line; this indicates that relative output by industry is little changed whether we make the low or high elasticities assumption.

Earlier Results from The Economic Council of Canada

Figures 11 and 12 are prepared in order that we might compare our results with those published by the Council in their Discussion paper 344 (Magun et al., 1988), hereafter referred to as DP 344. The changes calculated (in this study) under the low elasticities assumption are contrasted with DP 344 in Figure 11, the comparison between DP 344 and our high elasticities case is shown in Figure 12.

In our low elasticities scenario there is very little change in per capita income in Canada. The lower cost and hence price of manufactured goods induces consumers to shift out of services and into manufactured goods (see Figure 40 in chapter III). Under the high elasticities scenario, there is a significant increase in national income and consumer demand for all products rises; therefore, in Figure 12 output in the service industries is as great or greater than DP 344. Since in this scenario the elasticities used are greater than those adopted by DP 344, we also get greater expansion of manufacturing exports sales.

Output Changes: DP 344 vs This Study

High Elasticities

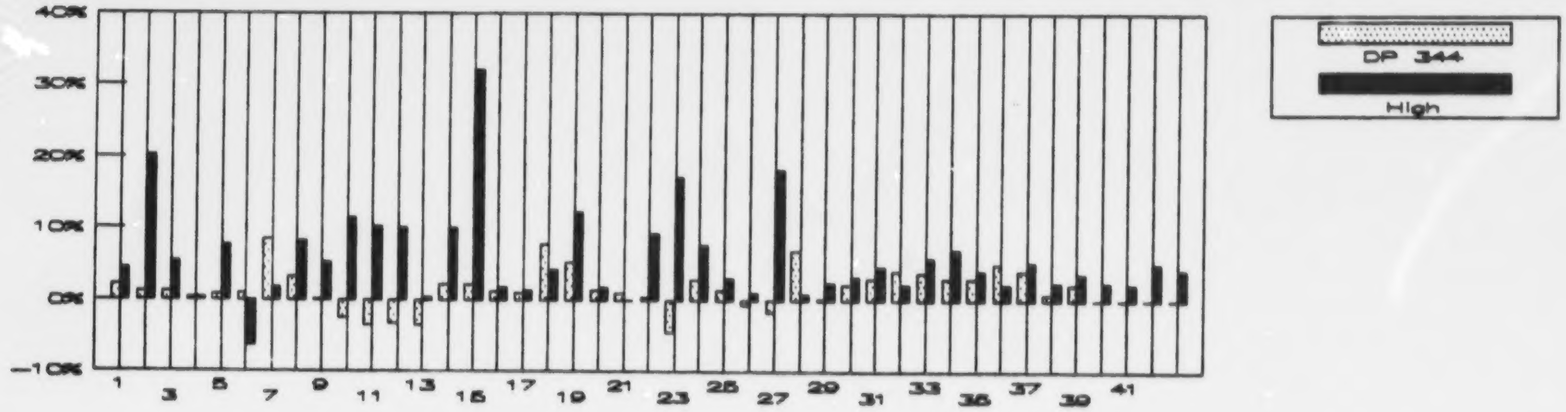


Figure 11

Low Elasticities

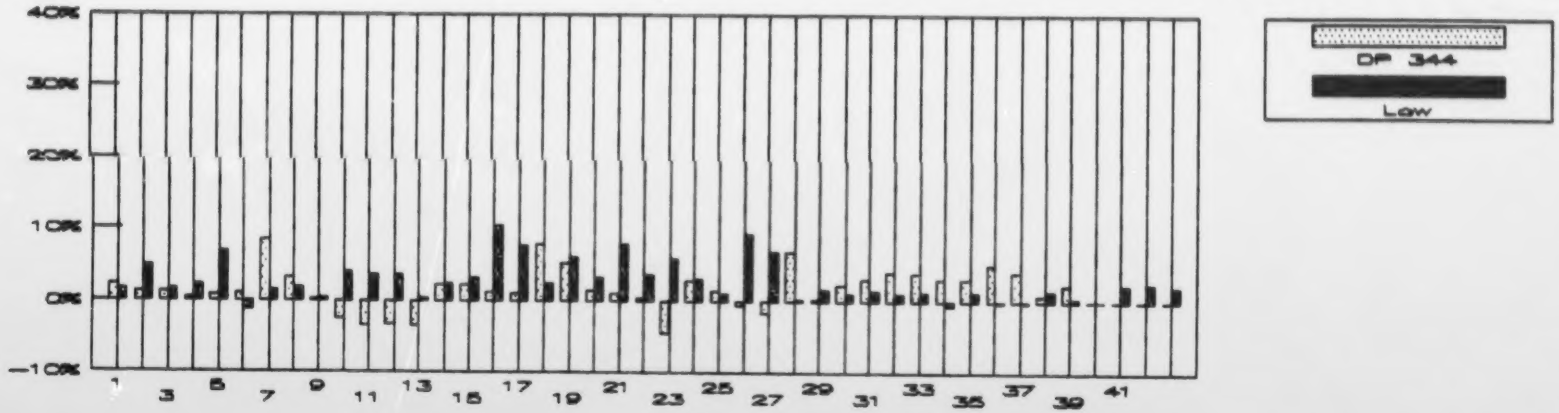


Figure 12

In some industrial groups expansion is notably large and therefore, calls for special comment. The United States NTBs on products of the Wood Industries (15) are greater than those which apply to any other class (see Tables 1 and figure 3). Export expansion causes an increase in Canadian output of 32.1 percent and purchases of raw materials induce an expansion of 20 percent in the Forestry (2) classification. The Primary Metal Industries (19) are the second most constrained by United States NTBs. This group shows growth of 12.2 percent. The amount that the US government purchasing bias has restrained output of the Miscellaneous Manufacturing Industries (27) was more than any other industry classification. When this barrier is removed, export expansion is 18.2 percent. The removal of US government purchasing restrictions also partly explains the 17.15 percent expansion of the Electrical Products Industries (23) but note also that this class of producers is the one which shows the greatest benefits from economies of scale. As was pointed out in Chapter I, the textile and clothing classifications (10 - 14) is a group which, prior to the agreement, was charged well above average US duties. Both export expansion and growth of domestic sales explain the above average expansion of 10, 11, 12 and 14.

As we noted in Chapter I, calculations in DP 344 are done through an iterative process which involves calculation of (1) an initial vector of net exports, (2) calculations from the

Statistics Canada Input-Output Model and (3) calculations using CANDIDE. Although there is a mechanism in CANDIDE which brings average costs to equal price in the long-run, there is no mechanism in DP 344 for the cost-price adjustment in CANDIDE to modify the calculations in step (1) or (2). Although CANDIDE itself will react to assumed changes in costs (due to economies of scale) these cannot induce further export expansion since this has already been determined in step 1. (For technical reasons, the import and export vectors generated in CANDIDE itself could not be used.) As a result, exports and hence production of manufactured goods are underestimated when compared to our results.

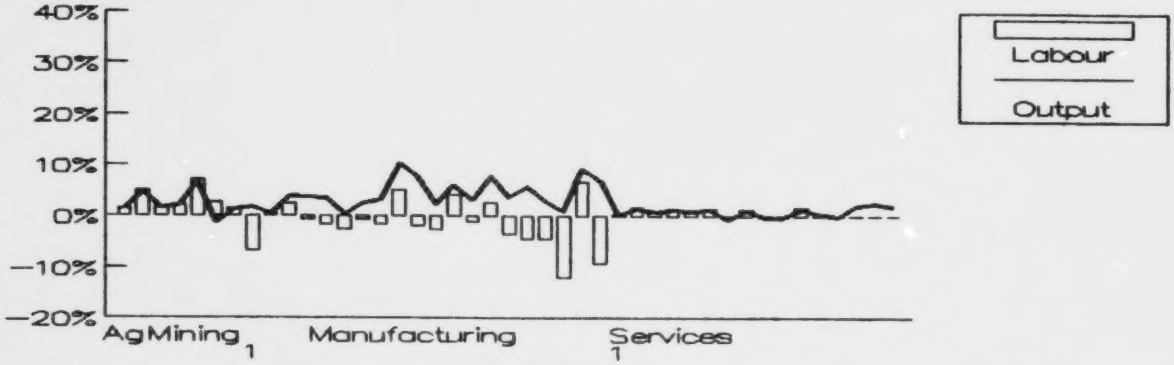
As far as output by industry is concerned, this study indicates that the agreement leads to expansion in most industries but leaves the pattern of production in Canada little changed.

CHANGES IN EMPLOYMENT REQUIREMENTS BY INDUSTRY

In the section dealing with the key indicators, it was shown that the total amount of labour required in the national economy increases even though the amount needed per unit of output in manufacturing declines. This is true whether we assume elasticities are high or low. What is true of the aggregate, however, need not be true in every industry. It was shown in the previous section that we should expect output to expand in all but two industries under the high elasticities assumption, but this does not mean that the amount of labour required must increase in every industry. In some, the reduced requirements of labour per unit of output will be offset by the increase in the level of production; in others this will not be so.

The contrast is seen in Figures 13 and 14 where we have displayed the percentage change in output and the percentage change in labour requirements on the same diagrams. The dark line indicates the change in output by industry and the bars represent the change in labour requirements. As noted above, the change in output is usually positive, but in many industries expanded output is not sufficient to make up for reduced labour requirements per unit of output. Figure 13 shows the contrast under the low elasticities assumption. Clearly there are many cases in the manufacturing sector where labour requirements decline even though output increases. Figure 14 shows the same contrast under the high elasticities assumption. Here, output expansion more often offsets the decline per unit of labour requirements and the declines in labour requirements are smaller than in the low elasticities case.

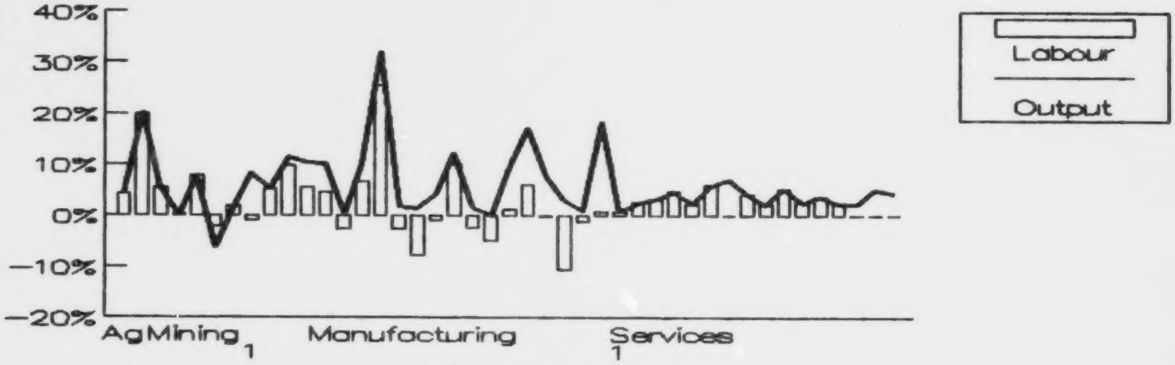
The labour saving effects of scale economies should not be prejudged. Under the high elasticities assumption, employment



Labour Required Compared to Output

Low Elasticities

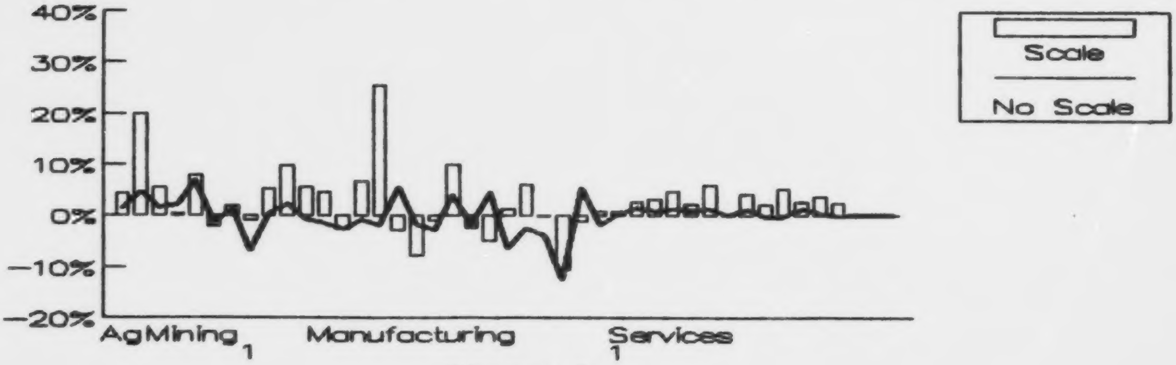
Figure 13



Labour Required Compared to Output

High Elasticities

Figure 14



Labour Required; High Elasticities

With and Without Economies of Scale

Figure 15

Percentage Changes in Labour Required

High vs Low Elasticities

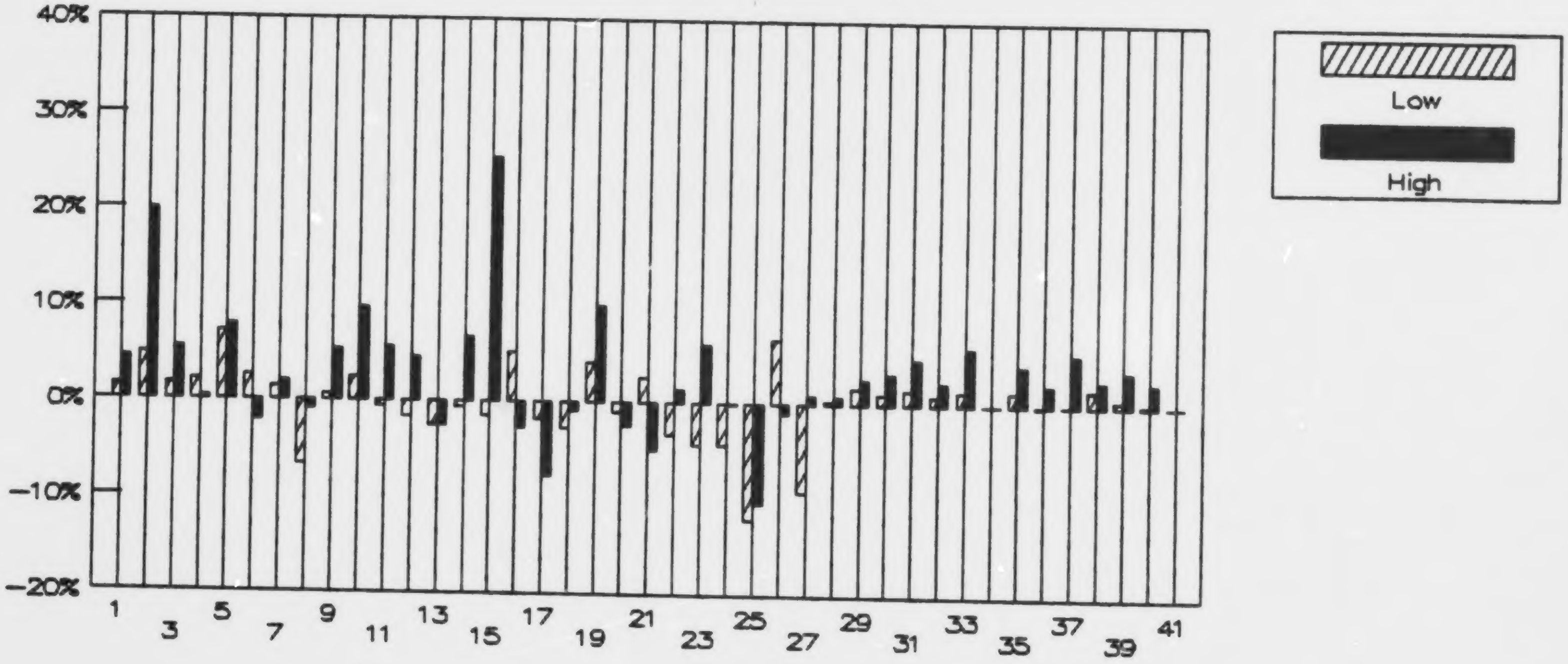


Figure 16

in many industries may be greater than it would be in the absence of economies of scale. Economies of scale lead to higher income and lower prices (relative to goods outside manufacturing) and thus increase demand for manufactured goods. This can be seen in Figure 15 where the bars represent employment changes under the high elasticities assumption and with scale economies present - scenario 6. The line shows employment changes under scenario 3 in which there are no scale economies. The combination of scale economies and high elasticities expands labour requirements in more industries than does free trade with no scale economies present. Unfortunately, the contrast is not as clear as we might wish because the scenario 6 involves more trade liberalization than does scenario 3 which assumes only that tariffs are reduced. Nevertheless, the figure makes the general point - labour saving changes in an industry need not lead to unemployment.

In Figure 16 the percentage change in employment per unit of output under the high elasticities assumption is compared to the low elasticities case. This figure is larger and we are therefore able to show the industry numbers on the abscissa. The filled bars represent percentage changes which we expect to occur under the high elasticities assumption; the partially filled bars represent the percentage changes we expect under the low elasticities assumption. Industries 8 through 27 are the manufacturing industries. In the industries outside manufacturing, labour requirements per unit of output do not change and, since output increases in most of these, labour requirements must also increase. Potential loses in labour requirements are found within manufacturing.

Industries within manufacturing where labour requirements expand may be identified by referring to Table 5. Under the high elasticities assumption there is an increase in the Tobacco Products Industries (9), all textile industries (10 - 14) except Knitting Mills (13), the Wood Industries (15), the Primary Metal Industries (19), the Transportation Equipment Industries (22), Electrical Products Industries (23) and in Miscellaneous Manufacturing Industries (27). The remaining industries all show decline under the high elasticities scenario.

In manufacturing industries that show decline under both the high and low elasticities scenarios, costs and other factors dominate over the tendency for free trade to stimulate expansion. Under either the high or low elasticities assumption, labour requirements decline in the Food & Beverage Industries (8), Knitting Mills (13), Paper & Allied Industries (17), Printing and Publishing (18), Metal Fabricating (20), Non-Metallic Mineral Products Industries (24), and the Petroleum & Coal Products Industries (25).

Employment requirements, as defined in this study, are measured as a weighted average of the skill groups in each

TABLE 5

Percentage Changes in Employment by Industry

	Industry	1981 Wages (000) (1)	Elasticities: High (2)	Low (3)
1.	Agriculture	1,343	4.31%	1.53%
2.	Forestry	1,618	19.91%	4.88%
3.	Fishing, Hunting & Trapping	230	5.42%	1.66%
4.	Metal Mines	1,932	0.31%	2.14%
5.	Mineral Fuels	1,385	7.80%	7.07%
6.	Non-Metal Mines & Quarries	541	-2.23%	2.58%
7.	Services Incidental to Mining	1,284	1.87%	1.39%
8.	Food & Beverage Industries	4,968	-0.89%	-6.72%
9.	Tobacco Products Industries	232	5.25%	0.50%
10.	Rubber & Plastics Products Ind	1,302	9.69%	2.39%
11.	Leather Industries	389	5.59%	-0.69%
12.	Textile Industries	1,264	4.56%	-1.64%
13.	Knitting Mills	281	-2.64%	-2.68%
14.	Clothing Industries	1,383	6.59%	-0.72%
15.	Wood Industries	2,566	25.50%	-1.50%
16.	Furniture & Fixture Industries	929	-2.73%	5.14%
17.	Paper & Allied Industries	3,608	-7.80%	-1.88%
18.	Printing & Publishing	2,354	-0.98%	-2.71%
19.	Primary Metal Industries	3,615	10.01%	4.11%
20.	Metal Fabricating Industries	3,642	-2.41%	-1.04%
21.	Machinery Industries	2,684	-4.99%	2.60%
22.	Transportation Equipment Ind	4,911	1.32%	-3.42%
23.	Electrical Products Industries	2,865	5.97%	-4.42%
24.	Non-Metallic Mineral Prod Ind	1,363	-0.19%	-4.44%
25.	Petroleum & Coal Products Ind	810	-10.48%	-12.13%
26.	Chemical & Chemical Prod Ind	2,315	-1.17%	6.70%
27.	Misc Manufacturing Industries	1,284	0.84%	-9.35%
28.	Construction Industry	17,196	0.78%	0.21%
29.	Transportation & Storage	10,577	2.49%	1.57%
30.	Communication	5,503	3.22%	0.9[illegible]%
31.	Elec Power, Gas, & Other Ind	2,678	4.72%	1.47%
32.	Wholesale Trade	11,031	2.18%	0.95%
33.	Retail Trade	13,791	5.81%	1.40%
34.	Owner Occupied Dwellings	0	0.00%	0.00%
35.	Finance, Ins. & Real Estate	13,678	4.12%	1.30%
36.	Education & Health Services	2,843	2.10%	-0.18%
37.	Amusement & Recreation	766	5.29%	-0.08%
38.	Serv to Business Management	7,402	2.60%	1.60%
39.	Accommodation & Food Serv	5,096	3.66%	0.54%
40.	Other Personal * Misc. Serv	1,757	2.40%	0.08%
41.	Transportation Margins	0	0.00%	0.00%
42.	Operating, Office, Lab & Food	0	0.00%	0.00%
43.	Travel, Advertising; Promotion	0	0.00%	0.00%

industry; 1981 wage rates are used as the weights. The concept used in DP 344 differs from this. The Council's employment figures are computed from job-output ratios. These ratios represent Statistic Canada's estimates of the number of jobs per unit of gross output and thus represent an unweighted average. Despite the labour saving aspect of economies of scale, the percentage changes in employment in Table 12 of the Council's paper 344 show increases in employment in all cases where gross output increases. Decreases occur only in cases where output decreases. The concept used in this study shows greater sensitivity to the economies of scale assumption. Since, with one exception, output in all industries increases, employment declines are attributable solely to the decline in labour required per unit of output.

Since, with the exceptions of Non-Metal Mines and Quarries (6), there are output increases in the agricultural, mining and services sectors under both sets of assumptions, and since there is no fall in labour requirements per unit of output in these industries, we must expect labour requirements to expand as Table 5 shows. Within the manufacturing sector, expansion of labour required is more likely to actually materialize in those industries which, in Table 5, are shown to expand under both the high and low elasticities assumption. Those industries which are shown to decline under both scenarios are those in which labour requirements are most likely to fall as the agreement matures. As noted above, the consensus of expert opinion would favour the high elasticities assumption and therefore this scenario represents a more probable outcome than the low elasticities assumption. Industries in which labour requirements expand under this assumption are more favoured than those which do not.

CONCLUSION

Under the bilateral agreement output should expand in nearly all industries. Even under the low elasticity assumption there are few exceptions. The changes in the levels of output can be explained in general terms by changes in the terms of trade, the level of national income and by the assumed level of export elasticities. Variations in detail can be explained in terms of the variation in NTBs, the tariff schedules, or changes in the bias in government procurement. Since the expansion is greatest in the manufacturing sector under both the low and high elasticity cases, and since economies of scale are assumed to be present only in manufacturing, we may conclude that cost changes are the dominant feature in accounting for the changes in output by industry. The agreement should not change the relative sizes of Canadian industries.

Labour requirements are more sensitive. Although total labour requirements increase and although output in nearly all industries increase, there are employment decreases in many manufacturing industries. The number actually showing decline will depend on Canada's export success in the US market.

CHAPTER III

EXPORTS AND IMPORTS

In the previous chapter, the discussion of output and employment follows the 43-member Input-Output industrial classification. In the simulations, output and labour requirements are defined in accordance with the industrial classification but exports, imports and consumption are defined by the 92-member Input-Output commodity classification. For purposes of analysis, we wish to present the trade data in terms of the same classification used in connection with the output and labour requirements data. By so doing, we are able to identify the industrial classifications in which there will be the greatest export expansion and greatest increase in import competition.

In order for such comparisons to be made, a concordance is needed between the commodity and the industrial classifications. Such a concordance can be constructed using data tables listing the industrial distribution of each commodity's output. Each industry is then assigned exports or imports of a commodity in proportion to its 1981 production. An industrial class that produced 10 percent of a commodity in

1981 is assigned 10 percent of the exports or imports of that commodity.

This device is adopted purely for the purposes of presentation. The solution to the model reports exports and imports in terms of commodities and for many purposes this additional detail is very important. For example, the industrial classification defines a category called Transportation Equipment (22) which includes motor vehicles. Motor vehicles (55) and Motor Vehicle Parts (56) are reported separately in the commodity code. We shall present results below in terms of both classifications.

CHANGES IN EXPORTS BY INDUSTRY

Exports to the ROW and the US under the high and low elasticities assumptions are presented in Figures 17 and 18 which are based on the data of Table 6. The solid lines in these two diagrams show the changes taking place in any industry under the high elasticities assumption and the bars show the changes under the low elasticities assumption.

TABLE 6

Change in Exports to US, ROW and All Nations

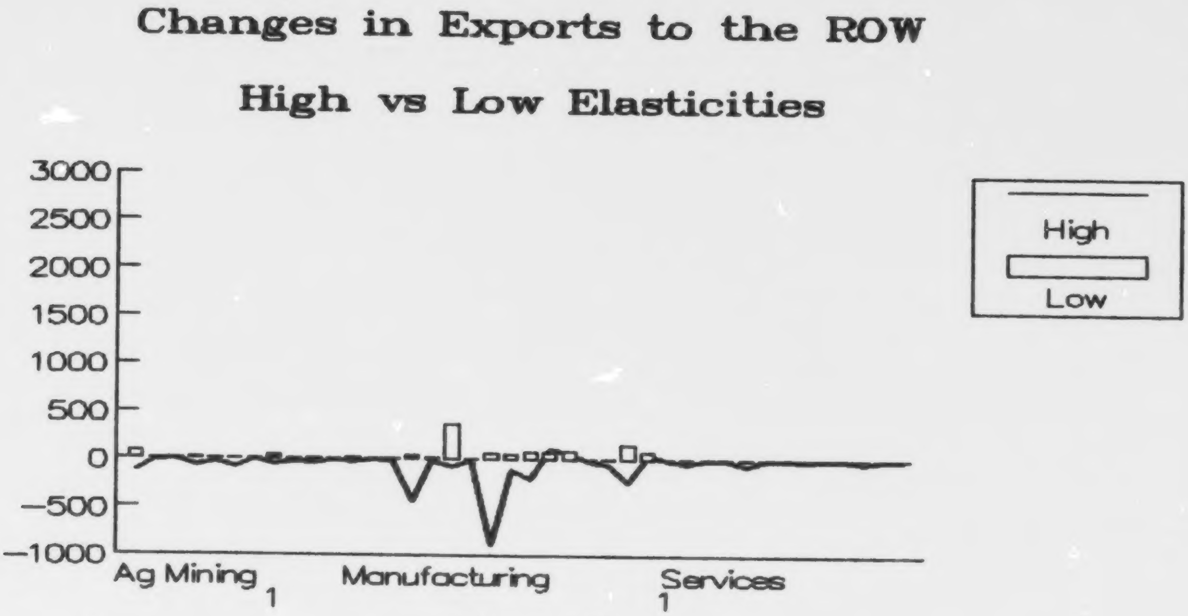
	Industry	All Nations (1000) (1)	Change Assuming Elaticities:		US Exports (1000) (4)	Change Assuming Elaticities:		ROW Exports (1000) (7)	Change Assuming Elaticities:	
			Low (2)	High (3)		Low (5)	High (6)		Low (8)	High (9)
1.	Agriculture	5486.76	111.68	-108.78	519.38	32.44	19.34	4967.37	79.23	-128.12
2.	Forestry	112.79	1.50	2.15	46.70	0.83	6.05	66.09	0.67	-3.91
3.	Fishing, Hunting & Trapping	239.43	3.72	-4.06	136.28	3.01	-1.85	103.15	0.71	-2.21
4.	Metal Mines	4665.81	45.80	-140.32	2587.56	27.22	-71.90	2078.25	18.58	-68.42
5.	Mineral Fuels	7364.62	1010.50	908.25	6274.75	1010.04	935.23	1089.86	0.46	-26.99
6.	Non-Metal Mines & Quarries	1777.13	20.29	-184.32	787.26	16.78	-105.64	989.87	3.50	-78.68
7.	Services Incidental to Mining	19.96	3.10	1.24	13.51	2.58	2.62	6.44	0.52	-1.38
8.	Food & Beverage Industries	4033.28	108.55	795.84	2036.59	65.13	842.19	1996.69	43.42	-46.35
9.	Tobacco Products Industries	138.00	3.68	15.39	35.02	2.62	40.94	102.98	1.06	-25.56
10.	Rubber & Plastics Products Ind	946.53	114.57	270.37	787.86	103.16	298.12	158.67	11.40	-27.75
11.	Leather Industries	109.28	22.54	73.55	83.01	20.12	77.20	26.27	2.41	-3.65
12.	Textile Industries	800.85	74.67	199.37	472.66	53.44	225.62	328.19	21.22	-26.25
13.	Knitting Mills	33.90	3.16	22.15	13.65	2.33	24.47	20.24	0.83	-2.32
14.	Clothing Industries	256.53	41.83	220.57	147.35	34.71	238.18	109.18	7.12	-17.61
15.	Wood Industries	3707.76	155.57	2192.39	2479.29	112.62	2625.04	1228.47	42.95	-432.65
16.	Furniture & Fixture Industries	307.97	230.50	132.80	257.12	213.19	146.79	50.85	17.32	-13.99
17.	Paper & Allied Industries	8608.28	936.77	-66.22	5769.62	563.09	7.08	2838.66	373.68	-73.30
18.	Printing & Publishing	233.82	19.75	-20.25	200.51	17.25	-15.75	33.31	2.50	-4.50
19.	Primary Metal Industries	7370.29	596.94	1234.13	4234.16	531.05	2127.57	3136.12	65.88	-893.43
20.	Metal Fabricating Industries	2051.13	338.02	294.68	1397.48	273.22	398.87	653.65	64.81	-104.20
21.	Machinery Industries	3897.68	480.35	123.68	2844.40	399.25	323.03	1053.28	81.10	-199.35
22.	Transportation Equipment Ind.	14455.68	688.44	1611.93	12950.78	609.27	1504.34	1504.90	79.17	107.60
23.	Electrical Products Industries	2223.16	352.09	992.20	1382.14	259.05	921.83	841.02	93.04	70.37
24.	Non-Metallic Mineral Prod Ind	564.44	77.92	197.59	429.25	72.27	209.81	135.19	5.64	-12.22
25.	Petroleum & Coal Products Ind	2563.67	95.50	-69.22	2207.41	82.21	-19.32	356.26	13.30	-49.90
26.	Chemical & Chemical Prod Ind	2634.66	636.23	-151.98	1588.82	470.58	81.53	1045.84	165.65	-233.41
27.	Misc Manufacturing Industries	1231.34	180.70	383.09	611.99	102.94	340.74	619.35	77.76	42.36
28.	Construction Industry	3.59	0.03	-0.17	2.43	0.02	-0.11	1.15	0.01	-0.05
29.	Transportation & Storage	2201.87	34.69	-62.76	1486.45	23.96	-34.03	715.43	10.74	-28.73
30.	Communication	235.59	17.96	43.28	152.30	12.94	41.01	83.30	5.02	2.27
31.	Elec Power, Gas, & Other Ind	1208.26	5.73	-34.71	1202.49	5.67	-34.41	5.76	0.06	-0.31
32.	Wholesale Trade	2656.04	45.05	-105.80	1798.04	32.60	-50.10	857.99	12.45	-55.70
33.	Retail Trade	97.23	1.77	8.29	55.35	1.18	9.57	41.88	0.59	-1.27
34.	Owner Occupied Dwellings	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35.	Finance, Ins. & Real Estate	461.61	4.00	-20.53	313.22	2.71	-13.93	148.39	1.28	-6.60
36.	Education & Health Services	69.43	0.72	-4.26	47.17	0.49	-2.89	22.26	0.23	-1.37
37.	Amusement & Recreation	6.93	0.06	-0.27	4.70	0.04	-0.18	2.23	0.02	-0.09
38.	Serv to Business Management	1384.00	11.88	-77.62	939.09	8.06	-52.67	444.91	3.82	-24.95
39.	Accommodation & Food Serv	1.68	0.02	-0.08	1.14	0.01	-0.05	0.54	0.01	-0.03
40.	Other Personal & Misc. Serv.	38.24	0.43	-1.90	25.95	0.29	-1.29	12.29	0.14	-0.61
		74603.43								

Exports to the United States

Under the low elasticities assumption, exports to the US are increased in all industrial classes because of the lower trade barriers, and, in manufacturing, because of the lower cost due to economies of scale in that sector. In the high elasticities scenario, the results are more mixed. Total US exports are greater and there are increases in most manufacturing categories [exceptions are Paper and Allied Industries (17), Printing and Publishing (18) and Petroleum & Coal Products (25), the Chemical & Chemical Products Industries (26)] but declines occur outside manufacturing. The increase in demand for Canadian exports causes the terms of trade to improve.

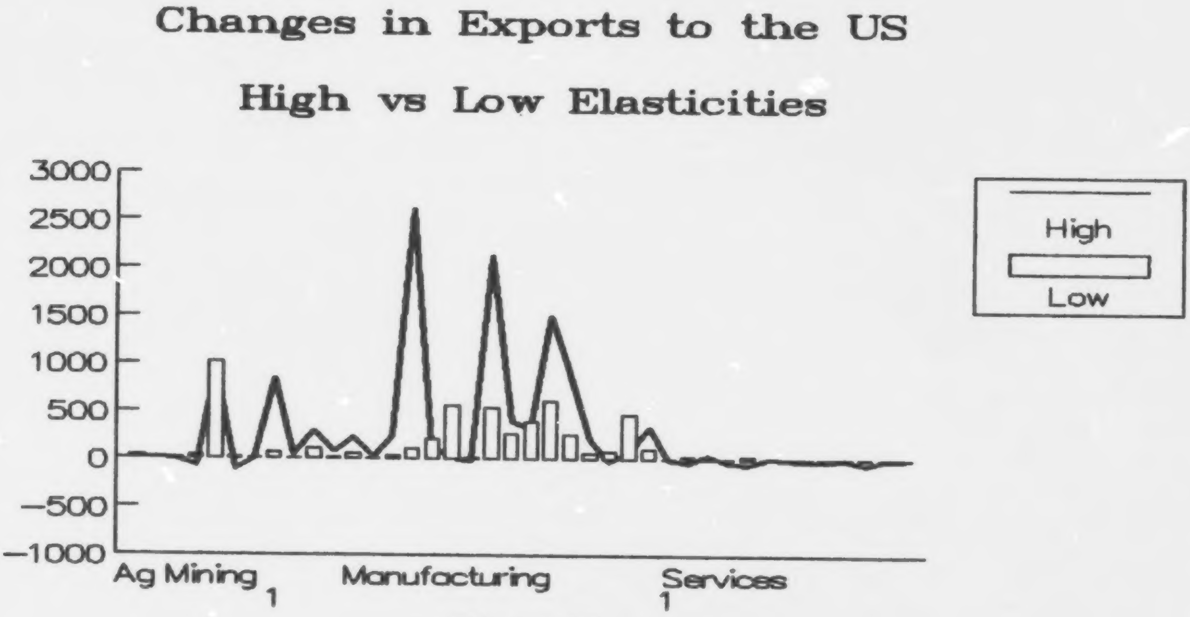
Exports to the Rest of The World

Exports to the ROW are shown in Figure 17. Under the high elasticities scenario, the rise in Canada's terms of trade causes exports to the ROW to decline in all industrial classes except four. Since there is a corresponding increase in exports to the US, this represents a redirection in the exports of most industries away from trade with the ROW toward greater trade with the US. The exceptions (where exports to ROW increase in manufacturing) can be identified from Table 6. In the manufacturing sector, cost decreases and economies of


Changes in Exports to the ROW

High vs Low Elasticities

Figure 17


Changes in Exports to the US

High vs Low Elasticities

Figure 18

scale are lead to export expansion of commodities produced by the Transportation Equipment Industries (22), the Electrical Products Industries (23) and Miscellaneous Manufacturing Industries (27). In all but the Transportation Equipment Industries (22) exports are greater than the reference period but less than under the low elasticities assumptions. Outside of the manufacturing sector, there is only one industry classification for which exports are greater than in the reference period. Exports of the Communication (30) classification are greater but not as great as they are under the high elasticities scenario.

In the low elasticities scenario, the decline in the Canadian terms of trade causes exports to the ROW to increase in all industrial categories [except Owner Occupied Dwellings (34)]. In this case trade with both areas is expanded.

Exports to United States and Domestic Supply

Whether or not the change in exports should be regarded as significant depends on the size of the industry being affected. The ratio of exports to total supply in each industry is shown for the US in columns 5, 6 and 7 of Table 7 for the reference year 1981 and for the low and high elasticities scenarios; these data are presented graphically in Figures 19 and 20.

In Figure 19 the ratios for exports to the US are shown; the dark line shows the high elasticities case. This may be compared to the export ratio under low elasticities, shown as bars; these ratios define a pattern of US exports by industry. Under the high elasticities scenario, the export ratios are greater in the majority of manufacturing classes [exceptions are Furniture & Fixtures (16), the Paper & Allied Industries (17), Printing and Publishing (18), the Machinery Industries (21), Petroleum & Coal Products (25) and Chemical & Chemical Products (26)]. Outside manufacturing the ratios are lower in the majority of cases. Nevertheless, the patterns are similar. Had we also shown the ratios for the reference period, they also would resemble those for the high and low elasticities cases. The variation in exports shown in Figure 19 is not sufficient under either scenario to alter the pattern of export ratios.

Rest of World Exports and Domestic Supply

Columns 8, 9 and 10 of Table 7 and Figure 20 indicates that a similar conclusion holds for the ROW. The pattern of exports to the ROW is similar under the low and high elasticities assumption but, because of the fall in Canada's terms of trade, more is exported to the ROW under the low elasticities assumption. As a result, changes in total exports are less than we might expect. Exports to the US and the ROW are

TABLE 7

Ratio of Exports by Industry to Base Year Output: Free Trade Compared to 1981

	(1000)	Ratio for All Exports			Ratio for Exports to US			Ratio for Exports to ROW		
Industry	Output 1981 (1)	Reference Year (2)	Elasticities: Low (3)	Elasticities: High (4)	Reference Year (5)	Elasticities: Low (6)	Elasticities: High (7)	Reference Year (8)	Elasticities: Low (9)	Elasticities: High (10)
1. Agriculture	18,701	0.293	0.299	0.288	0.028	0.030	0.029	0.266	0.270	0.259
2. Forestry	4,585	0.025	0.025	0.025	0.010	0.010	0.012	0.014	0.015	0.014
3. Fishing, Hunting & Trapping	928	0.258	0.262	0.254	0.147	0.150	0.145	0.111	0.112	0.109
4. Metal Mines	7,108	0.656	0.663	0.637	0.364	0.368	0.354	0.292	0.295	0.283
5. Mineral Fuels	19,112	0.385	0.438	0.433	0.328	0.381	0.377	0.057	0.057	0.056
6. Non-Metal Mines & Quarries	2,400	0.740	0.749	0.664	0.328	0.335	0.284	0.412	0.414	0.380
7. Services Incidental to Mining	3,737	0.005	0.006	0.006	0.004	0.004	0.004	0.002	0.002	0.001
8. Food & Beverage Industries	32,502	0.124	0.127	0.149	0.063	0.065	0.089	0.061	0.063	0.060
9. Tobacco Products Industries	1,444	0.096	0.098	0.106	0.024	0.026	0.053	0.071	0.072	0.054
10. Rubber & Plastics Products Ind	4,781	0.198	0.222	0.255	0.165	0.186	0.227	0.033	0.036	0.027
11. Leather Industries	1,250	0.087	0.105	0.146	0.066	0.083	0.128	0.021	0.023	0.018
12. Textile Industries	5,193	0.154	0.169	0.193	0.091	0.101	0.134	0.063	0.067	0.058
13. Knitting Mills	946	0.036	0.039	0.059	0.014	0.017	0.040	0.021	0.022	0.019
14. Clothing Industries	4,216	0.061	0.071	0.113	0.035	0.043	0.091	0.026	0.028	0.022
15. Wood Industries	8,527	0.435	0.453	0.692	0.291	0.304	0.599	0.144	0.149	0.093
16. Furniture & Fixture Industries	2,823	0.109	0.191	0.156	0.091	0.167	0.143	0.018	0.024	0.013
17. Paper & Allied Industries	16,012	0.538	0.596	0.533	0.360	0.395	0.361	0.177	0.201	0.173
18. Printing & Publishing	6,573	0.036	0.039	0.032	0.031	0.033	0.028	0.005	0.005	0.004
19. Primary Metal Industries	18,001	0.409	0.443	0.478	0.235	0.265	0.353	0.174	0.178	0.125
20. Metal Fabricating Industries	12,716	0.161	0.188	0.184	0.110	0.131	0.141	0.051	0.056	0.043
21. Machinery Industries	9,202	0.424	0.476	0.437	0.309	0.352	0.344	0.114	0.123	0.093
22. Transportation Equipment Ind	22,823	0.633	0.664	0.704	0.567	0.594	0.633	0.066	0.069	0.071
23. Electrical Products Industries	9,671	0.230	0.266	0.332	0.143	0.170	0.238	0.087	0.097	0.094
24. Non-Metallic Mineral Prod Ind	4,888	0.115	0.131	0.156	0.088	0.103	0.131	0.028	0.029	0.025
25. Petroleum & Coal Products Ind	20,792	0.123	0.128	0.120	0.106	0.110	0.105	0.017	0.018	0.015
26. Chemical & Chemical Prod Ind	13,811	0.191	0.237	0.180	0.115	0.149	0.121	0.076	0.088	0.059
27. Misc Manufacturing Industries	4,354	0.283	0.324	0.371	0.141	0.164	0.219	0.142	0.160	0.152
28. Construction Industry	57,952	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29. Transportation & Storage	28,019	0.079	0.080	0.076	0.053	0.054	0.052	0.026	0.026	0.025
30. Communication	11,120	0.021	0.023	0.025	0.014	0.015	0.017	0.007	0.008	0.008
31. Elec Power, Gas, & Other Ind	11,689	0.103	0.104	0.100	0.103	0.103	0.100	0.000	0.000	0.000
32. Wholesale Trade	22,322	0.119	0.121	0.114	0.081	0.082	0.078	0.038	0.039	0.036
33. Retail Trade	28,564	0.003	0.003	0.004	0.002	0.002	0.002	0.001	0.001	0.001
34. Owner Occupied Dwellings	21,076	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35. Finance, Ins. & Real Estate	44,326	0.010	0.011	0.010	0.007	0.007	0.007	0.003	0.003	0.003
36. Education & Health Services	8,187	0.008	0.009	0.008	0.006	0.006	0.005	0.003	0.003	0.003
37. Amusement & Recreation	3,250	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
38. Serv to Business Management	16,105	0.086	0.087	0.081	0.058	0.059	0.055	0.028	0.028	0.026
39. Accommodation & Food Serv	13,833	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40. Other Personal & Misc. Serv.	4,120	0.009	0.009	0.009	0.006	0.006	0.006	0.003	0.003	0.003

Change in Export—Output Ratio
United States: High vs Low Elasticities

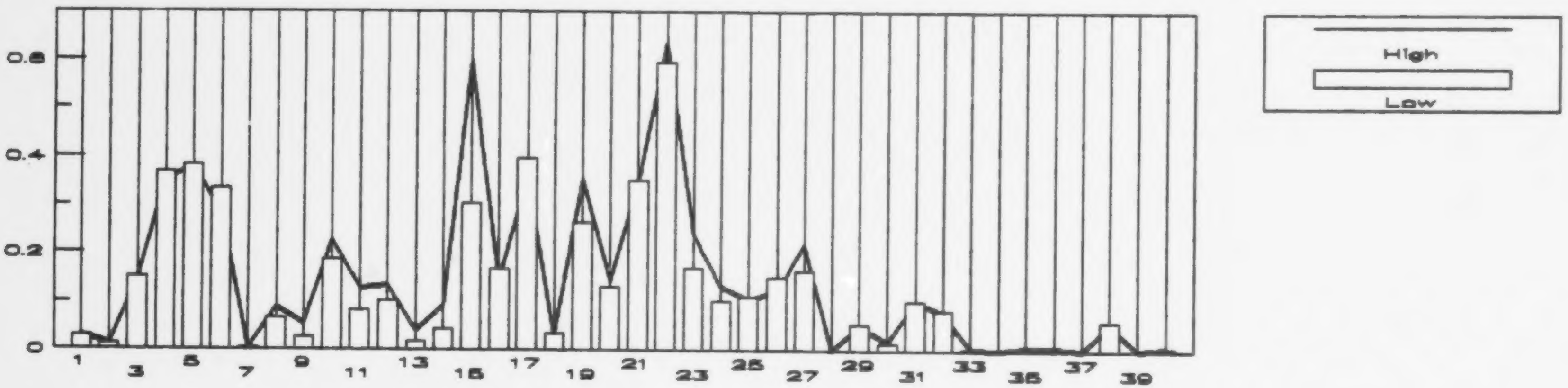


Figure 19

Changes in Export—Output Ratio
R.O.W.: High vs Low Elasticities

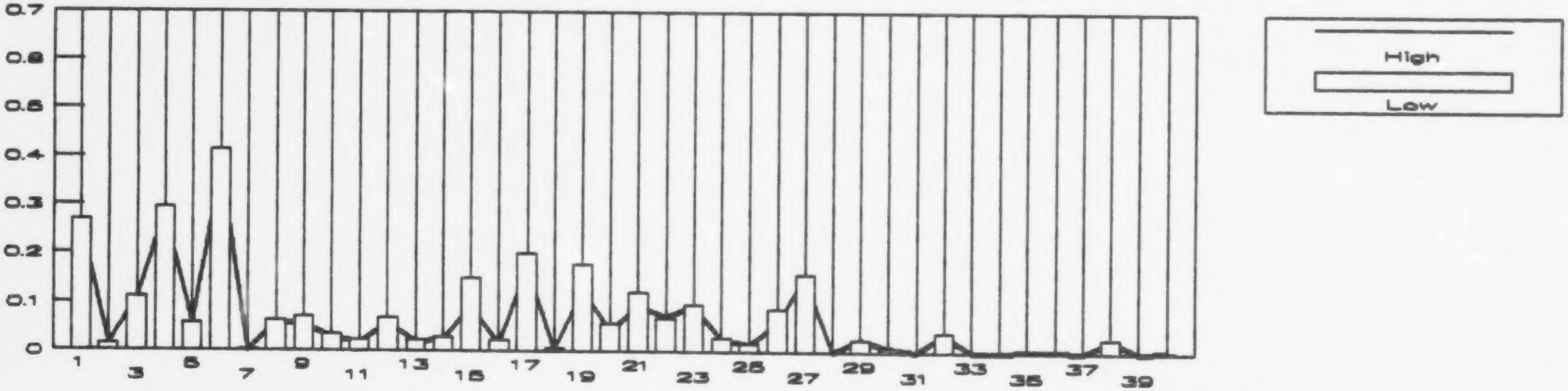


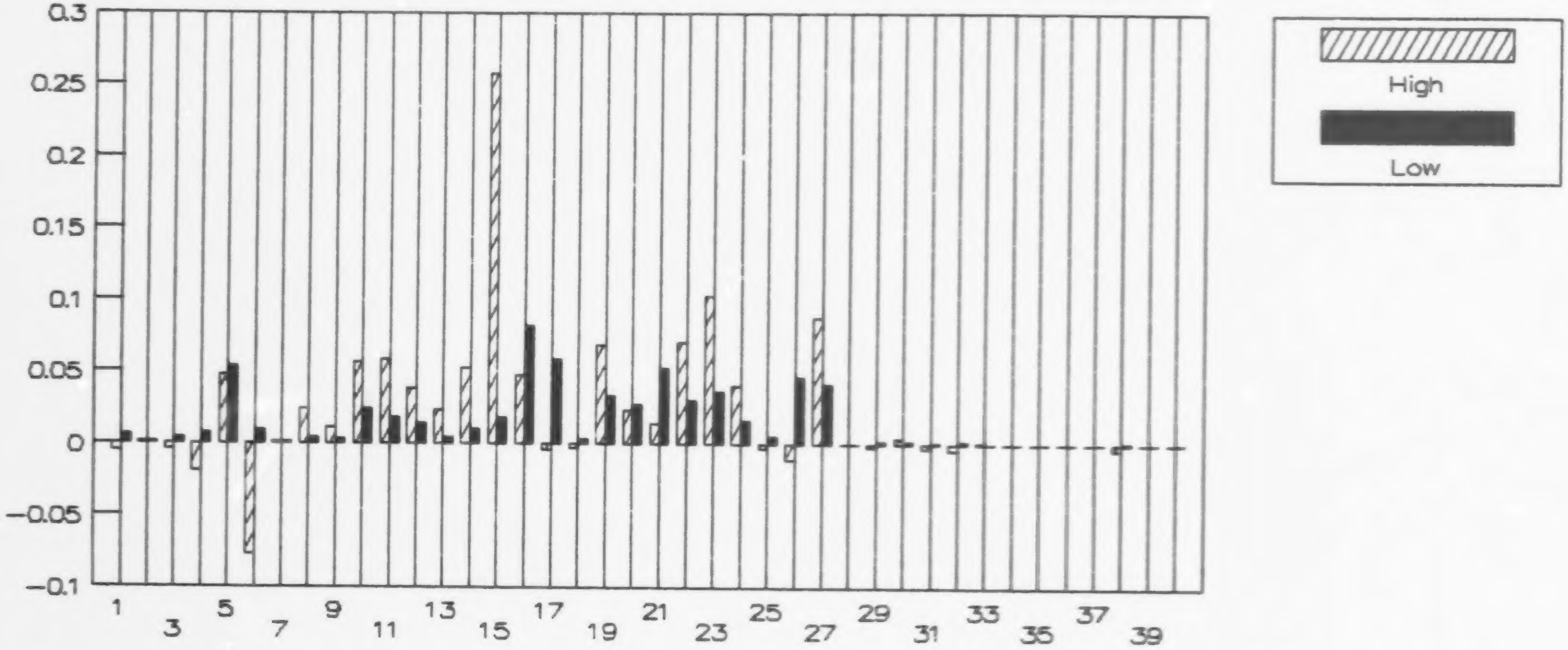
Figure 20

offsetting. More is shipped to the US and less to the ROW under the high elasticities assumption and more to the ROW and less to US under the low elasticities assumption.

Total Exports

Table 7 can be used to review the effect on total Canadian exports. Columns 2, 3 and 4 report exports by industry for the ROW and US combined. The ratios of total exports to national supply are again shown for the reference case and high and low elasticities. The difference between the export ratio under high elasticities and the reference period is shown in Figure 21 as the lighter oblique shaded bars. Positive numbers indicate that the export ratio will be greater under the bilateral agreement. Expansion is particularly notable in the Rubber & Plastics Products Industries (10), Leather Industries (11), the Wood Industries (15), Primary Metal Products Industries (19) and the Electrical Products Industries (23). In Chapter II we related these changes to the factors causing change which we discussed in Chapter I.

Declines in total exports are found in the mining and services sectors and, within the manufacturing sector, small declines in the Paper & Allied Industries (17), Printing and Publishing (18), Petroleum and Coal Products Industries (25) and Chemical



Ratio Difference Total Exports

High & Low Elasticities vs 1981

Figure 21

and Chemical Products Industries (28). The relatively large 6 percent decline in exports of the Non-Metal Mines and Quarries (6) was explained in the previous chapter. The US tariff in this industrial group is the lowest of all classifications. Canada's terms of trade improve by more than the fall in the US tariff.

The filled bars in Figure 21 show the ratio difference for low elasticities. Under the low elasticities assumption, exports per unit of output increase in all industries but particularly in manufacturing. The results obtained from the low and high elasticities assumption differ, but they are surprisingly similar. The export-output ratios tend to rise in all industries (with the exceptions noted above) and the greatest change is in manufacturing.

CHANGES IN EXPORTS BY COMMODITY

Tables 8 and 9 and the associated figures are based on the commodity classification. Table 8 is concerned with exports to the US. Column 1 in the table lists domestic supply for 1981 by commodity. Columns 2, 3 and 4 present exports by commodity for the reference year 1981, the high elasticities scenario and the low elasticity scenario, respectively. In Columns 5, 6 and 7 exports to the US are expressed per unit of domestic supply.

TABLE 8

Commodity Exports to US Compared to Domestic Supply under Various Scenarios

	Domestic Supply	Level of Exports to US			US Exports per Unit of Domestic Supply			US Exports per Unit Ratio Differences		
Commodity	1981 (1000) (1)	1981 (1000) (2)	Elasticities: High (3)	Low (4)	1981 Ratio (5)	Elasticities: High (6)	Low (7)	High Less Ref (8)	Low Less Ref (9)	High Less Low (10)
1. Grains	6,226	60	60	63	0.010	0.010	0.010	-0.000	0.000	-0.000
2. Live Animals	5,845	200	208	216	0.034	0.036	0.037	0.001	0.003	-0.001
3. Other Agricultural Products	6,340	252	260	266	0.040	0.041	0.042	0.001	0.002	-0.001
4. Forestry Products	4,643	36	35	37	0.008	0.008	0.008	-0.000	0.000	-0.000
5. Fish Landings	845	118	116	121	0.140	0.138	0.143	-0.002	0.003	-0.006
6. Hunting & Trapping Products	72	16	16	16	0.219	0.216	0.220	-0.003	0.001	-0.004
7. Iron Ores & Concentrates	1,653	601	578	608	0.364	0.350	0.368	-0.014	0.004	-0.018
8. Other Metal Ores & Concentrates	6,255	2,407	2,344	2,428	0.385	0.375	0.388	-0.010	0.003	-0.013
9. Coal	906	3	2	3	0.003	0.003	0.003	-0.000	0.000	-0.000
10. Crude Mineral Oils	10,245	1,838	2,749	2,838	0.179	0.268	0.277	0.089	0.098	-0.009
11. Natural Gas	5,992	3,948	3,950	3,951	0.659	0.659	0.659	0.000	0.000	-0.000
12. Non-Metallic Minerals	1,829	296	284	295	0.162	0.155	0.161	-0.007	-0.001	-0.006
13. Services Incidental to Mining	3,937	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
14. Meat Products	9,736	407	580	418	0.042	0.060	0.043	0.018	0.001	0.017
15. Dairy Products	4,573	9	24	10	0.002	0.005	0.002	0.003	0.000	0.003
16. Fish Products	1,550	671	714	681	0.433	0.461	0.439	0.028	0.006	0.021
17. Fruits & Vegetables Preps.	2,076	54	108	60	0.026	0.052	0.029	0.026	0.003	0.023
18. Feeds	3,063	68	73	71	0.022	0.024	0.023	0.001	0.001	0.001
19. Flour, Wheat, Meal & Cereals	760	39	58	43	0.052	0.076	0.056	0.025	0.005	0.020
20. B'fast Cereal & Bakery Prods.	2,261	60	60	62	0.027	0.026	0.027	-0.000	0.001	-0.001
21. Sugar	830	41	194	43	0.050	0.234	0.052	0.184	0.002	0.182
22. Misc. Food Products	3,874	178	239	190	0.046	0.062	0.049	0.016	0.003	0.013
23. Soft Drinks	1,246	4	4	4	0.003	0.003	0.003	0.000	0.000	0.000
24. Alcoholic Beverages	2,334	457	794	467	0.196	0.340	0.200	0.145	0.005	0.140
25. Tobacco Processed Unmanufactured	356	26	59	27	0.072	0.166	0.077	0.094	0.005	0.089
26. Cigarettes & Tobacco Mfg.	1,068	7	14	7	0.006	0.013	0.007	0.007	0.001	0.006
27. Tires & Tubes	1,202	319	333	343	0.265	0.277	0.285	0.012	0.020	-0.008
28. Other Rubber Products	640	43	95	50	0.066	0.148	0.078	0.082	0.012	0.070
29. Plastic Fabricated Products	2,111	172	402	220	0.081	0.190	0.104	0.109	0.023	0.086
30. Leather & Leather Products	1,091	69	137	88	0.063	0.125	0.080	0.062	0.017	0.045
31. Yarns & Man Made Fibres	1,118	39	86	45	0.035	0.077	0.040	0.042	0.005	0.037
32. Fabrics	1,735	43	117	49	0.025	0.067	0.028	0.042	0.003	0.039
33. Other Textile Products	1,848	68	140	91	0.037	0.076	0.049	0.039	0.012	0.027
34. Hosiery & Knitted Wear	971	4	13	5	0.004	0.014	0.005	0.010	0.001	0.009
35. Clothing & Accessories	3,949	148	397	184	0.037	0.100	0.047	0.063	0.009	0.054
36. Lumber & Timber	3,953	1,991	1,287	2,057	0.504	0.326	0.520	-0.178	0.017	-0.195
37. Veneer & Plywood	809	91	66	100	0.112	0.081	0.124	-0.031	0.011	-0.042
38. Other Wood Fab. Materials	3,754	442	3,965	475	0.118	1.056	0.127	0.939	0.009	0.930
39. Furniture & Fixtures	2,815	245	274	475	0.087	0.097	0.169	0.011	0.082	-0.071
40. Pulp	4,080	1,801	1,760	2,138	0.441	0.431	0.524	-0.010	0.082	-0.092
41. Newsprint & Other Paper Stock	7,471	3,728	3,698	3,914	0.499	0.495	0.524	-0.004	0.025	-0.029
42. Paper Products	4,374	151	210	176	0.034	0.048	0.040	0.014	0.006	0.008
43. Printing & Publishing	4,549	188	168	204	0.041	0.037	0.045	-0.004	0.003	-0.008
44. Advertising, Print Media	1,816	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000

Continued next page

TABLE 8 (Continued)

Commodity Exports to US Compared to Domestic Supply under Various Scenarios

Commodity	Domestic Supply	Level of Exports to US			US Exports per Unit of Domestic Supply			US Exports per Unit Ratio Differences		
	1981 (1000) (1)	1981 (1000) (2)	Elasticities: High (3)	Low (4)	1981 Ratio (5)	Elasticities: High (6)	Low (7)	High Less Ref (8)	Low Less Ref (9)	High Less Low (10)
45. Iron & Steel Products	8,467	1,138	4,018	1,600	0.134	0.475	0.189	0.340	0.055	0.286
46. Aluminum Products	2,997	774	586	799	0.258	0.195	0.267	-0.063	0.008	-0.071
47. Copper & Copper Alloy Products	1,704	357	283	370	0.209	0.166	0.217	-0.044	0.008	-0.051
48. Nickel Products	1,206	501	387	513	0.415	0.321	0.425	-0.095	0.010	-0.104
49. Other Non-Ferrous Metal Prods.	2,270	1,160	913	1,166	0.511	0.402	0.513	-0.109	0.002	-0.111
50. Boilers, Tanks & Plates	881	29	35	32	0.032	0.040	0.037	0.008	0.004	0.004
51. Fab. Structural Metal Prod.	2,823	259	288	353	0.092	0.102	0.125	0.010	0.033	-0.023
52. Other Metal Fab. Products	7,534	633	704	722	0.084	0.093	0.096	0.009	0.012	-0.002
53. Agricultural Machinery	1,417	728	594	752	0.513	0.419	0.530	-0.094	0.017	-0.111
54. Other Industrial Machinery	7,851	2,390	2,858	2,850	0.304	0.364	0.363	0.060	0.059	0.001
55. Motor Vehicles	12,015	8,790	9,481	9,127	0.732	0.789	0.760	0.057	0.028	0.029
56. Motor Vehicle Parts	5,945	3,629	4,049	3,813	0.610	0.681	0.641	0.071	0.031	0.040
57. Other Transport Equipment	5,238	1,409	1,887	1,532	0.269	0.360	0.292	0.091	0.023	0.068
58. Appliances & Receivers, H'hold	1,715	136	262	169	0.079	0.153	0.098	0.074	0.019	0.055
59. Other Electrical Products	8,294	1,216	2,179	1,470	0.147	0.263	0.177	0.116	0.031	0.086
60. Cement & Concrete Products	2,382	106	100	118	0.045	0.042	0.049	-0.003	0.005	-0.008
61. Other Non-Metal. Mineral Prod.	2,428	308	540	372	0.127	0.222	0.153	0.095	0.026	0.069
62. Gasoline & Fuel Oil	16,684	939	826	947	0.056	0.050	0.057	-0.007	0.000	-0.007
63. Other Petroleum & Coal Prods.	5,236	1,759	1,883	1,815	0.336	0.360	0.347	0.024	0.011	0.013
64. Industrial Chemicals	7,648	1,222	1,258	1,673	0.160	0.164	0.219	0.005	0.059	-0.054
65. Fertilizers	1,326	708	588	726	0.534	0.443	0.548	-0.091	0.014	-0.105
66. Pharmaceuticals	1,331	15	17	16	0.011	0.013	0.012	0.002	0.001	0.001
67. Other Chemical Products	4,780	181	229	249	0.038	0.048	0.052	0.010	0.014	-0.004
68. Scientific Equipment	1,527	306	587	373	0.200	0.384	0.244	0.184	0.044	0.140
69. Other Manufactured Products	3,030	229	388	288	0.076	0.128	0.095	0.053	0.020	0.033
70. Residential Construction	13,193	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
71. Non-Residential Construction	34,723	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
72. Repair Construction	9,674	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
73. Pipeline Transportation	2,056	366	347	370	0.178	0.169	0.180	-0.009	0.002	-0.011
74. Transportation & Storage	25,097	993	941	1,003	0.040	0.037	0.040	-0.002	0.000	-0.002
75. Radio & TV Broadcasting	1,592	11	11	11	0.007	0.007	0.007	-0.000	0.000	-0.000
76. Telephone & Telegraph	7,420	57	54	57	0.008	0.007	0.008	-0.000	0.000	-0.001
77. Postal Services	1,514	18	17	18	0.012	0.011	0.012	-0.001	0.000	-0.001
78. Electric Power	9,847	1,199	1,164	1,204	0.122	0.118	0.122	-0.003	0.001	-0.004
79. Other Utilities	1,581	0	0	0	0.000	0.000	0.000	-0.000	0.000	-0.000
80. Wholesale Margins	24,142	2,036	1,910	2,055	0.084	0.079	0.085	-0.005	0.001	-0.006
81. Retail Margins	23,413	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
82. Imputed Rent Owner Ocpd. Dwel.	21,077	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
83. Other Fin., Ins., Real Estate.	44,415	311	297	314	0.007	0.007	0.007	-0.000	0.000	-0.000
84. Business Services	13,741	927	875	935	0.067	0.064	0.068	-0.004	0.001	-0.004
85. Education Services	894	47	44	47	0.052	0.049	0.053	-0.003	0.001	-0.004
86. Health Services	7,286	0	0	0	0.000	0.000	0.000	-0.000	0.000	-0.000
87. Amusement & Recr. Services	3,051	4	4	4	0.001	0.001	0.001	-0.000	0.000	-0.000
88. Accommodation & Food Services	14,426	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
89. Other Personal & Misc. Servs.	14,984	96	91	97	0.006	0.006	0.006	-0.000	0.000	-0.000
90. Transportation Margins	10,935	2,429	2,304	2,454	0.222	0.211	0.224	-0.011	0.002	-0.014
91. Operating, Office, Lab. & Food	18,810	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
92. Travel, Advert. & Promotion	11,678	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
Total	569,079	58,752	69,670	63,945						

Columns 8, 9 and 10 in Tables 8 and 9 provide comparisons for analysis. In column 8, the ratio of exports to output in the 1981 reference period is subtracted from the same ratio under the high elasticities assumption. In column 9 the ratio of exports to output in the 1981 reference period is subtracted from the ratio of exports to output under the low elasticities assumption; in column 10 the low elasticities ratio is subtracted from the high elasticities ratio. By simply noting the sign in columns 8, 9 and 10 it is possible to determine if, say, Iron and Steel Products (45) increase under the high elasticities assumption as compared to the 1981 reference period or to the low elasticities situation.

Commodity Exports to the United States

Figures 22 and 23 present the US export data diagrammatically. Under the low elasticities assumption, it would appear from Figure 23 that exports of all commodities increase. From Table 8, however, we note that there is one exception: a very small decline in Non-Metallic Minerals (12) is too small to be noted in the figure.

Under the high elasticities assumption, Figure 22 shows that there are declines in exports of many commodities even though the overall expansion is greater. Most of the change occurs in the products produced in the manufacturing sector

US Exports Per $ of Supply

High Elasticities Less Reference Year

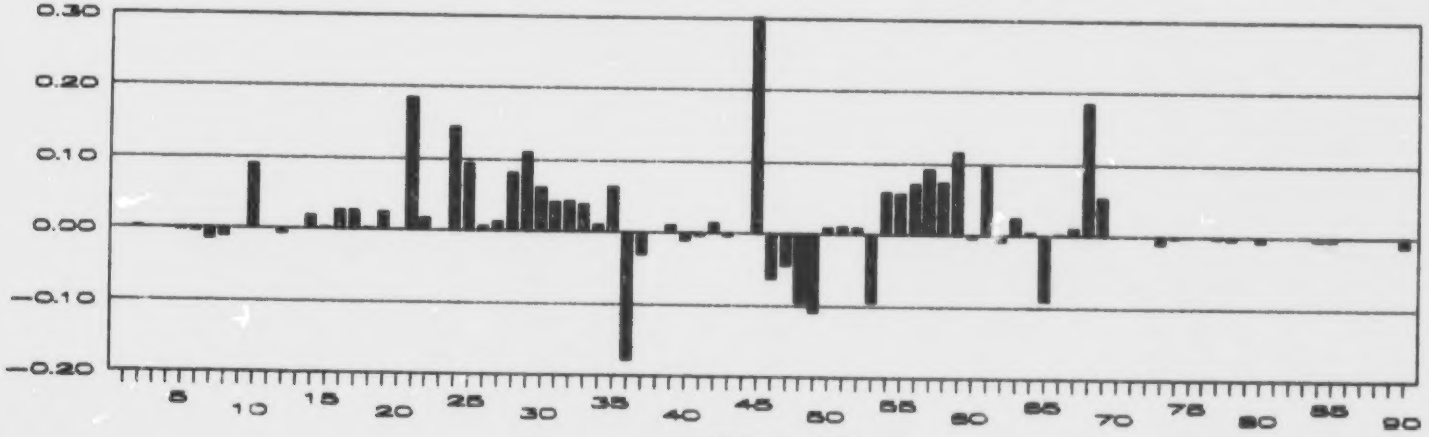


Figure 22

Low Elasticities less Reference Year

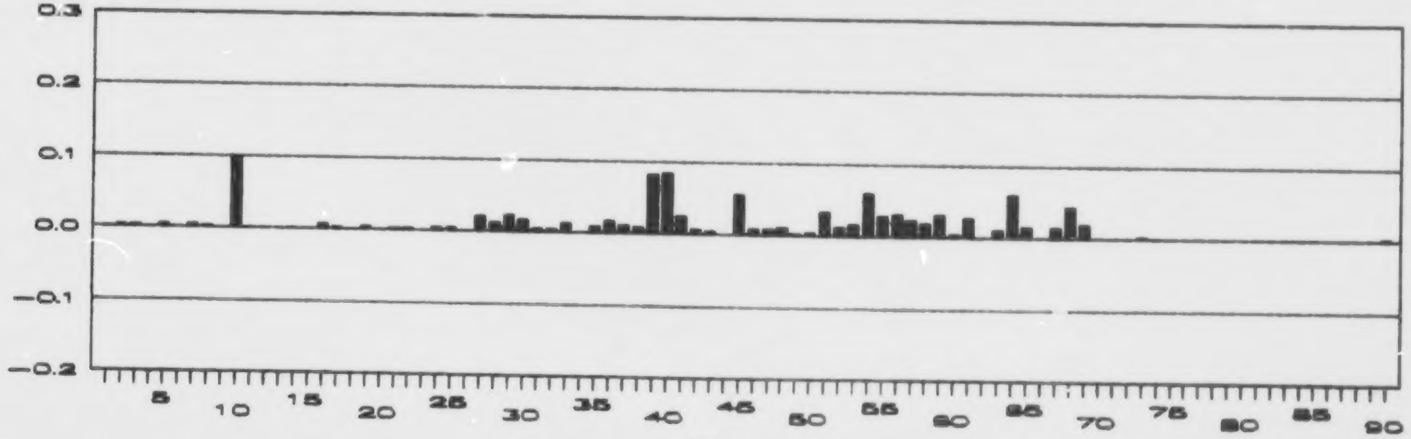


Figure 23

(commodities 14-69). Food processing (14-19, 21-22), beverages (23,24), tobacco (25,26), rubber and plastic products (27-29) and textiles (30-35) are the commodities for which the export ratio rises. On the other hand, wood products at the earlier stages of processing (lumber, timber veneer, plywood and pulp, 36, 37, 40, 41) are commodities whose export ratios decline while related commodities at the later stages of fabrication (wood fabricated materials, paper products, furniture and fixtures, 38, 39 42) increase. Similarly, the export ratios of commodities at the earlier stages of non-ferrous metals processing (46-49) decline while Iron and Steel Products (45) and the later stages of metals processing (50-52 and 54-59) expand. Included in the latter expanding group are motor vehicles, transport equipment and industrial machinery.

Study of columns 9 and 10 of Table 8 will reveal exceptions to the rule but generally, under the high elasticities, the export ratio of commodities produced at the later stages of processing is favoured while earlier stages of manufacturing, agriculture, mining and services decline. Under the low elasticities assumption, Canada's terms of trade decline and this stimulates exports from all commodity classes. Figure 23 or a review of column 9 of Table 8 confirms that, under the low elasticities case, the export ratio for nearly all commodities increases and this is especially true in the manufacturing classes.

ROW Exports Per $ of Supply

High Elasticities Less Reference Year

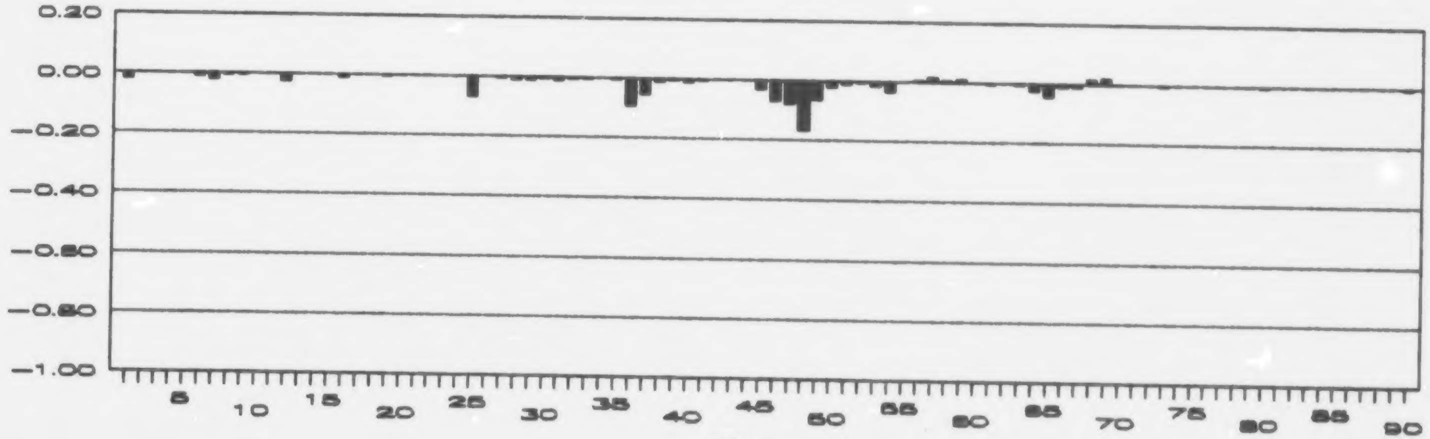


Figure 24

Low Elasticities Less Reference Year

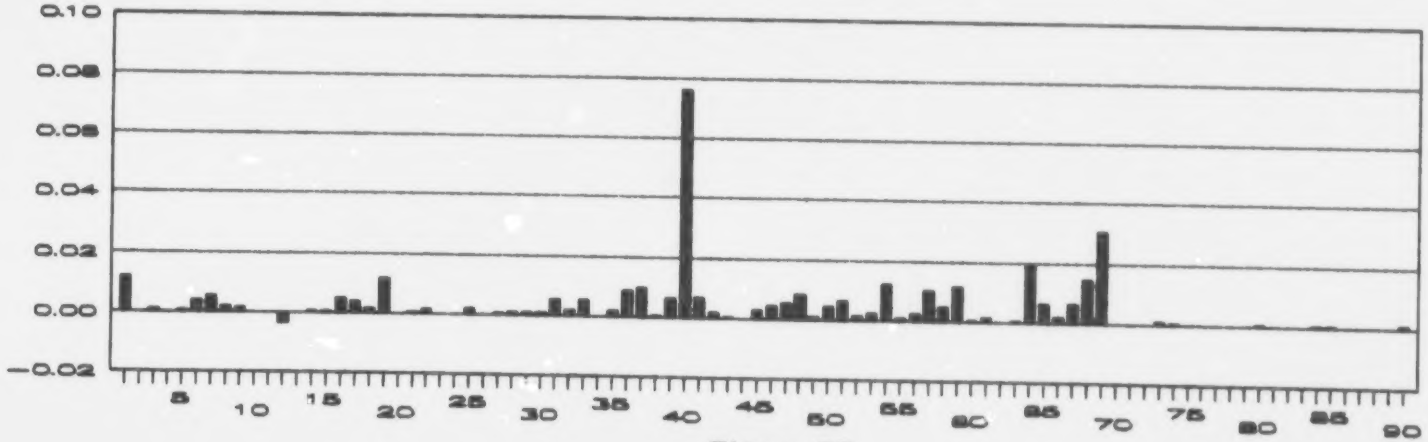


Figure 25

Commodity Exports to the Rest of the World

Figures 24 and 25 present the pattern of exports for the ROW. The decline in the export ratios under the high elasticities scenario (Figure 24) and increases in exports under the low elasticities scenario (Figure 25) reflect the change in the terms of trade. The increase in the terms of trade under the high elasticities scenario causes the ratio of ROW exports to domestic supply to decline in most categories and the fall in the terms of trade under the low elasticities assumption causes the ratios to rise.

Figure 24 suggests that there are certain commodity groups where the fall in the export ratio for the rest of the world is relatively large. Table 9 may be used to identify the commodity names of these. As in Table 8, the last three columns of Table 9 show the differences in export ratios by commodity. Commodities for which the ratio of exports to national supply falls the most are those for which the numbers are negative and large. Under the high elasticities assumption, exports of primary products decline the most. The declines is numerically greater than .05 percent in Tobacco Processed, Unmanufactured (25), Lumber & Timber (36), Veneer & Plywood (37) and non-ferrous metals (46-49).

Figure 25 shows that under the low elasticities assumption, with two exceptions, the change is more uniform; all ratios

TABLE 9

Commodity Exports to ROW Compared to Domestic Supply under Various Scenarios

	Domestic Supply	Level of Exports to ROW			ROW Exports per Unit of Domestic Supply			ROW Exports per Unit Ratio Differences		
Commodity	1981 (1000) (1)	1981 (1000) (2)	Elasticities: High (3)	Low (4)	1981 Ratio (5)	Elasticities: High (6)	Low (7)	High Less Ref (8)	Low Less Ref (9)	High Less Low (10)
1. Grains	6,226	4,198	4,082	4,269	0.67	0.66	0.69	-0.019	0.012	-0.030
2. Live Animals	5,845	34	34	35	0.01	0.01	0.01	-0.000	0.000	-0.000
3. Other Agricultural Products	6,340	735	723	741	0.12	0.11	0.12	-0.002	0.001	-0.003
4. Forestry Products	4,643	59	56	59	0.01	0.01	0.01	-0.000	0.000	-0.001
5. Fish Landings	845	45	43	45	0.05	0.05	0.05	-0.002	0.000	-0.002
6. Hunting & Trapping Products	72	56	55	56	0.78	0.77	0.78	-0.012	0.004	-0.015
7. Iron Ores & Concentrates	1,653	838	805	847	0.51	0.49	0.51	-0.020	0.005	-0.025
8. Other Metal Ores & Concentrates	6,255	1,508	1,466	1,519	0.24	0.23	0.24	-0.007	0.002	-0.008
9. Coal	906	730	725	731	0.81	0.80	0.81	-0.005	0.001	-0.006
10. Crude Mineral Oils	10,245	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
11. Natural Gas	5,992	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
12. Non-Metallic Minerals	1,829	1,061	1,015	1,054	0.58	0.55	0.58	-0.025	-0.004	-0.022
13. Services Incidental to Mining	3,937	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
14. Meat Products	9,736	432	424	438	0.04	0.04	0.05	-0.001	0.001	-0.002
15. Dairy Products	4,573	200	196	202	0.04	0.04	0.04	-0.001	0.000	-0.001
16. Fish Products	1,550	603	591	610	0.39	0.38	0.39	-0.008	0.005	-0.012
17. Fruits & Vegetables Preps.	2,076	204	200	213	0.10	0.10	0.10	-0.002	0.004	-0.006
18. Feeds	3,063	157	154	161	0.05	0.05	0.05	-0.001	0.001	-0.002
19. Flour, Wheat, Meal & Cereals	760	192	188	201	0.25	0.25	0.26	-0.005	0.011	-0.017
20. B'fast Cereal & Bakery Prods.	2,261	4	4	4	0.00	0.00	0.00	-0.000	0.000	-0.000
21. Sugar	830	35	34	35	0.04	0.04	0.04	-0.001	0.000	-0.001
22. Misc. Food Products	3,874	147	144	151	0.04	0.04	0.04	-0.001	0.001	-0.002
23. Soft Drinks	1,246	1	1	1	0.00	0.00	0.00	-0.000	0.000	-0.000
24. Alcoholic Beverages	2,334	13	13	13	0.01	0.01	0.01	-0.000	0.000	-0.000
25. Tobacco Processed Unmanufacture	356	93	69	93	0.26	0.19	0.26	-0.066	0.002	-0.068
26. Cigarettes & Tobacco Mfg.	1,068	8	6	8	0.01	0.01	0.01	-0.002	0.000	-0.002
27. Tires & Tubes	1,202	19	13	20	0.02	0.01	0.02	-0.005	0.000	-0.005
28. Other Rubber Products	640	17	12	18	0.03	0.02	0.03	-0.008	0.001	-0.009
29. Plastic Fabricated Products	2,111	50	33	52	0.02	0.02	0.02	-0.008	0.001	-0.009
30. Leather & Leather Products	1,091	15	11	16	0.01	0.01	0.01	-0.003	0.001	-0.004
31. Yarns & Man Made Fibres	1,118	137	124	142	0.12	0.11	0.13	-0.012	0.005	-0.017
32. Fabrics	1,735	77	70	80	0.04	0.04	0.05	-0.004	0.002	-0.006
33. Other Textile Products	1,848	83	74	93	0.05	0.04	0.05	-0.005	0.005	-0.010
34. Hosiery & Knitted Wear	971	3	2	3	0.00	0.00	0.00	-0.001	0.000	-0.001
35. Clothing & Accessories	3,949	110	91	117	0.03	0.02	0.03	-0.005	0.002	-0.006
36. Lumber & Timber	3,953	1,037	671	1,072	0.26	0.17	0.27	-0.093	0.009	-0.101
37. Veneer & Plywood	809	115	71	123	0.14	0.09	0.15	-0.054	0.010	-0.063
38. Other Wood Fab. Materials	3,754	100	66	101	0.03	0.02	0.03	-0.009	0.000	-0.009
39. Furniture & Fixtures	2,815	39	24	56	0.01	0.01	0.02	-0.005	0.006	-0.011
40. Pulp	4,080	1,665	1,627	1,976	0.41	0.40	0.48	-0.009	0.076	-0.085
41. Newsprint & Other Paper Stock	7,471	1,049	1,030	1,101	0.14	0.14	0.15	-0.003	0.007	-0.010
42. Paper Products	4,374	76	75	84	0.02	0.02	0.02	-0.000	0.002	-0.002
43. Printing & Publishing	4,549	24	20	26	0.01	0.00	0.01	-0.001	0.000	-0.001
44. Advertising, Print Media	1,816	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000

Continued next page

TABLE 9 (Continued)
Commodity Exports to ROW Compared to Domestic Supply under Various Scenarios

	Domestic Supply	Level of Exports to ROW			ROW Exports per Unit of Domestic Supply			ROW Exports per Unit Ratio Differences		
Commodity	1981 (1000) (1)	1981 (1000) (2)	Elasticities: High (3)	Low (4)	1981 Ratio (5)	Elasticities: High (6)	Low (7)	High Less Ref (8)	Low Less Ref (9)	High Less Low (10)
45. Iron & Steel Products	8,467	732	491	756	0.09	0.06	0.09	-0.028	0.003	-0.031
46. Aluminum Products	2,997	641	443	655	0.21	0.15	0.22	-0.066	0.004	-0.071
47. Copper & Copper Alloy Products	1,704	436	301	445	0.26	0.18	0.26	-0.079	0.005	-0.084
48. Nickel Products	1,206	671	469	680	0.56	0.39	0.56	-0.167	0.008	-0.175
49. Other Non-Ferrous Metal Prods.	2,270	523	376	525	0.23	0.17	0.23	-0.065	0.001	-0.066
50. Boilers, Tanks & Plates	881	66	50	70	0.08	0.06	0.08	-0.018	0.004	-0.022
51. Fab. Structural Metal Prod.	2,823	105	74	123	0.04	0.03	0.04	-0.011	0.006	-0.017
52. Other Metal Fab. Products	7,534	147	111	157	0.02	0.01	0.02	-0.005	0.001	-0.006
53. Agricultural Machinery	1,417	108	87	112	0.08	0.06	0.08	-0.015	0.002	-0.017
54. Other Industrial Machinery	7,851	1,140	894	1,233	0.15	0.11	0.16	-0.031	0.012	-0.043
55. Motor Vehicles	12,015	351	379	365	0.03	0.03	0.03	0.002	0.001	0.001
56. Motor Vehicle Parts	5,945	321	346	336	0.05	0.06	0.06	0.004	0.003	0.002
57. Other Transport Equipment	5,238	908	982	962	0.17	0.19	0.18	0.014	0.010	0.004
58. Appliances & Receivers, H'hold	1,715	60	68	68	0.04	0.04	0.04	0.004	0.005	-0.000
59. Other Electrical Products	8,294	807	907	904	0.10	0.11	0.11	0.012	0.012	0.000
60. Cement & Concrete Products	2,382	13	12	15	0.01	0.00	0.01	-0.001	0.001	-0.001
61. Other Non-Metal. Mineral Prod.	2,428	69	62	73	0.03	0.03	0.03	-0.003	0.002	-0.005
62. Gasoline & Fuel Oil	16,684	132	115	133	0.01	0.01	0.01	-0.001	0.000	-0.001
63. Other Petroleum & Coal Prods.	5,236	258	224	261	0.05	0.04	0.05	-0.006	0.000	-0.007
64. Industrial Chemicals	7,648	733	549	882	0.10	0.07	0.12	-0.024	0.020	-0.044
65. Fertilizers	1,326	336	279	345	0.25	0.21	0.26	-0.043	0.006	-0.050
66. Pharmaceuticals	1,331	76	63	78	0.06	0.05	0.06	-0.010	0.002	-0.012
67. Other Chemical Products	4,780	211	163	242	0.04	0.03	0.05	-0.010	0.006	-0.016
68. Scientific Equipment	1,527	184	203	206	0.12	0.13	0.13	0.012	0.014	-0.002
69. Other Manufactured Products	3,030	573	635	665	0.19	0.21	0.22	0.021	0.030	-0.010
70. Residential Construction	13,193	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
71. Non-Residential Construction	34,723	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
72. Repair Construction	9,674	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
73. Pipeline Transportation	2,056	173	164	175	0.08	0.08	0.09	-0.004	0.001	-0.005
74. Transportation & Storage	25,097	470	446	475	0.02	0.02	0.02	-0.001	0.000	-0.001
75. Radio & TV Broadcasting	1,592	5	5	5	0.00	0.00	0.00	-0.000	0.000	-0.000
76. Telephone & Telegraph	7,420	27	25	27	0.00	0.00	0.00	-0.000	0.000	-0.000
77. Postal Services	1,514	8	8	8	0.01	0.01	0.01	-0.000	0.000	-0.000
78. Electric Power	9,847	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
79. Other Utilities	1,581	0	0	0	0.00	0.00	0.00	-0.000	0.000	-0.000
80. Wholesale Margins	24,142	965	905	973	0.04	0.04	0.04	-0.002	0.000	-0.003
81. Retail Margins	23,413	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
82. Imputed Rent Owner Ocpd. Dwel.	21,077	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
83. Other Fin., Ins., Real Estate.	44,415	147	141	149	0.00	0.00	0.00	-0.000	0.000	-0.000
84. Business Services	13,741	439	414	443	0.03	0.03	0.03	-0.002	0.000	-0.002
85. Education Services	894	22	21	22	0.02	0.02	0.03	-0.002	0.000	-0.002
86. Health Services	7,286	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
87. Amusement & Recr. Services	3,051	2	2	2	0.00	0.00	0.00	-0.000	0.000	-0.000
88. Accommodation & Food Services	14,426	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
89. Other Personal & Misc. Servs.	14,984	45	43	46	0.00	0.00	0.00	-0.000	0.000	-0.000
90. Transportation Margins	10,935	1,151	1,091	1,163	0.11	0.10	0.11	-0.005	0.001	-0.007
91. Operating, Office, Lab. & Food	18,810	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
92. Travel, Advert. & Promotion	11,678	0	0	0	0.00	0.00	0.00	0.000	0.000	0.000
Total	569,079									

tend to rise by less than .02 percent. In the two exceptional cases where the rise is greater than .02 are Pulp (40) which increases by .076 and Other Manufactured Products (69) which increases by .03.

As far as the ROW is concerned, the results we get under the high elasticities assumption differ from those we get under the low elasticities assumption primarily in their impact on resource exports. With high elasticities there is a relatively large shift away from exports of primary products. The analysis of US trade, on the other hand, shows a shift into later stages of manufacturing. The two together imply that the bilateral agreement will lead to upgrading of the level of processing in Canada. There will be less exported to the ROW at the earlier stages of processing and more to the US at the later stages.

Total Exports by Commodity

The impact on total exports is examined in Figures 26 and 27. The dark lines in these figures show the ratio of exports to domestic production as it was in 1981. The upper figure compares 1981 ratios to those expected under the high elasticities assumption and the lower figure makes the comparison for the low elasticities case. In both cases the pattern of Canadian exports as described by these ratios is

Total Exports Per $ of Supply

High Elasticities

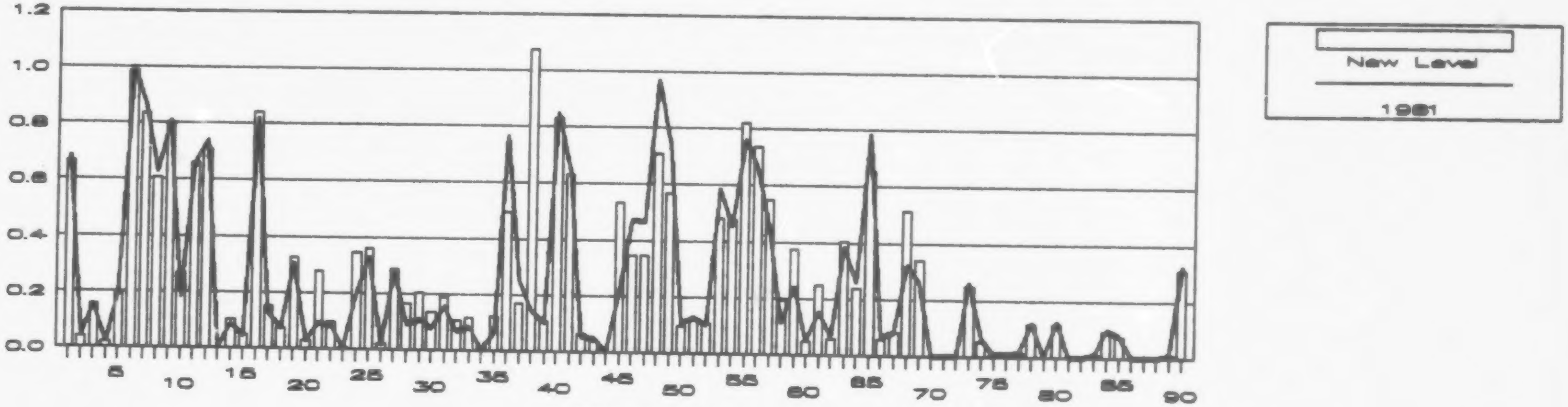


Figure 26

Low Elasticities

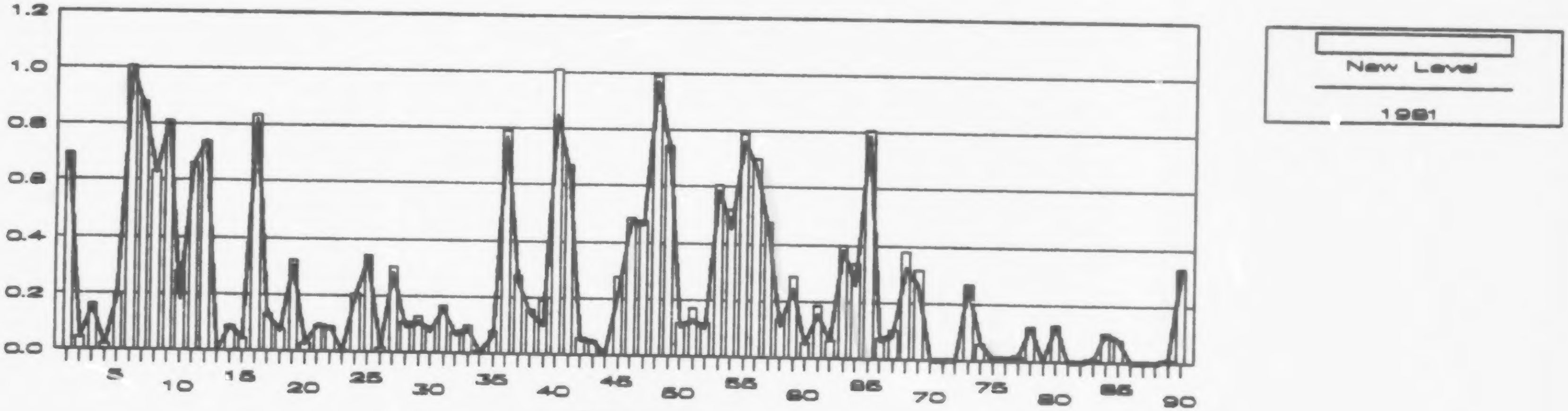


Figure 27

similar to 1981 but the resemblance is much closer when we make the low elasticities assumption.

The ratio of exports to supply differs in the low elasticities scenario from its value in 1981 by more than .05 in 8 cases: Crude Mineral Oils (10), Furniture and Fixtures (39), Pulp (40), Iron & Steel Products (45), Other Industrial Machinery (54), Industrial Chemicals (64), Scientific Equipment (68) and Other Manufactured Products (69). In all classes there are increases. In only one case, Pulp (40), is the increase greater than .1. The uniform increase in exports is due to the fall in Canada's terms of trade.

Under the high elasticities assumption, agricultural products [except live animals (2)], forestry products, fishing and hunting and mining (1 - 9) decline. There is a shift toward later stages of processing. Increases are found in all food and textiles classes (14 - 35) except Breakfast Cereal & Bakery Products (20). Declines occur in Lumber & Timber (36), Veneer and Plywood (37) but increases occur in Other Wood Fabricated Material (38) and Furniture and Fixtures (39); there is a decrease in Pulp (40) and Newsprint & Other Paper Stock (41) but an increase in Paper Products (42). Iron Ores & Concentrates (7), Other Metal Ores and Concentrates (8) and Coal (9) and non-ferrous metal (46 - 49) decline but we have increases in Iron and Steel Products (45), Other Metal Fabricated Products (52), Other Industrial Machinery (54), motor vehicles and parts (55 & 56) and a number of other end product classes (57 - 59, 68, 69). The are three cases where later stage processing declines: Boilers, Tanks & Plates (50), Fabricated Structural Metal Products (49) and Agricultural Machinery (53). Non-metal products and chemical products tend to decline (60, 62, 64 - 66). Also, in the high elasticities case, there is a decline in service classifications.

The change in total exports merely corroborates what was concluded when the US and the ROW were examined earlier. Under the high elasticities assumption there is a shift toward manufacturing, and within manufacturing toward later stages of processing. Under the low elasticities assumption the expansion is more or less uniform in all export categories.

IMPORTS BY INDUSTRY

In order to facilitate comparison with the presentation of output and employment data in Chapter I, this section is concerned with imports classified by industry. We shall discuss imports in terms of the commodity classification in the section to follow. In both, we refer only to goods imported by the private sector for use as final or intermediate goods.

TABLE 10

Changes in Final and Intermediate Imports by Industry from US, ROW and All Nations

Industry	Level 1981 (1000)	Change All Sources Elasticities:		Level 1981 (1000)	Change US Elasticities:		Level 1981 (1000)	Change ROW Elasticities:	
	(1)	Low (2)	High (3)	(4)	Low (5)	High (6)	(7)	Low (8)	High (9)
1. Agriculture	1,669.89	25.48	132.56	1,442.09	23.49	116.41	227.80	1.99	16.15
2. Forestry	99.71	4.29	19.16	96.47	4.25	18.84	3.24	0.05	0.32
3. Fishing, Hunting & Trapping	167.62	3.55	15.69	131.25	2.81	12.36	36.37	0.74	3.33
4. Metal Mines	1,896.86	105.77	210.85	1,306.54	73.19	146.03	590.32	32.58	64.82
5. Mineral Fuels	9,424.07	123.50	331.37	2,426.47	51.79	119.15	6,997.60	71.72	212.21
6. Non Metal Mines & Quarries	343.53	12.88	14.22	294.19	11.07	12.10	49.34	1.81	2.12
7. Services Incidental to Mining	21.00	0.81	0.76	17.28	0.67	0.63	3.72	0.14	0.13
8. Food & Beverage Industries	3,233.88	40.39	233.20	1,602.02	35.73	129.44	1,631.87	4.66	103.76
9. Tobacco Products Industries	38.83	1.09	3.38	24.82	1.12	2.59	14.01	(0.03)	0.79
10. Rubber & Plastics Products Ind	1,822.87	55.12	125.70	1,373.18	50.11	100.54	449.69	5.01	25.16
11. Leather Industries	635.13	3.86	51.06	145.13	8.92	18.69	490.00	(5.06)	32.37
12. Textile Industries	2,477.32	67.89	201.89	1,696.69	53.67	145.05	780.63	14.22	56.84
13. Knitting Mills	430.58	7.72	38.44	140.16	9.08	18.99	290.41	(1.37)	19.45
14. Clothing Industries	843.12	3.61	67.74	154.90	15.41	27.86	688.22	(11.80)	39.88
15. Wood Industries	640.49	16.80	65.68	518.51	14.39	55.07	121.99	2.42	10.61
16. Furniture & Fixture Industries	291.11	16.76	45.95	178.04	20.49	38.75	113.07	(3.73)	7.20
17. Paper & Allied Industries	1,268.33	48.11	64.19	1,068.69	41.60	55.00	199.64	6.51	9.18
18. Printing & Publishing	889.03	13.67	52.82	748.82	11.89	45.26	140.21	1.79	7.56
19. Primary Metal Industries	4,308.52	189.00	320.53	2,800.76	129.08	227.85	1,507.77	59.92	92.67
20. Metal Fabricating Industries	3,685.73	96.64	197.17	2,615.13	81.60	150.02	1,070.59	15.05	47.15
21. Machinery Industries	3,690.42	128.27	155.14	3,006.49	112.73	130.41	683.93	15.53	24.74
22. Transportation Equipment Ind.	12,035.44	241.72	947.69	10,279.88	241.69	828.99	1,755.55	0.03	118.70
23. Electrical Products Industries	3,680.71	76.11	329.11	2,579.83	118.63	289.19	1,100.88	(42.52)	39.92
24. Non-Metallic Mineral Prod Ind	969.79	16.66	50.29	697.74	15.82	36.05	272.05	0.84	14.24
25. Petroleum & Coal Products Ind	1,295.17	29.53	56.53	559.13	19.69	23.31	736.04	9.84	33.22
26. Chemical & Chemical Prod Ind	3,661.62	171.50	218.50	2,821.43	140.29	177.42	840.19	31.20	41.08
27. Misc Manufacturing Industries	2,685.26	45.72	202.57	1,660.93	57.48	149.56	1,024.33	(11.76)	53.01
28. Construction Industry	9.83	0.08	0.64	6.74	0.05	0.44	3.09	0.02	0.20
29. Transportation & Storage	798.90	16.44	34.64	557.70	11.60	24.34	241.20	4.84	10.31
30. Communication	320.10	4.62	20.24	233.19	3.72	15.09	86.90	0.89	5.16
31. Elec Power, Gas, & Other Ind	28.53	0.55	1.53	21.27	0.43	1.15	7.26	0.11	0.38
32. Wholesale Trade	543.89	12.92	33.88	381.80	12.06	26.07	162.09	0.86	7.81
33. Retail Trade	136.29	0.99	8.77	87.75	0.76	5.72	48.54	0.23	3.04
34. Owner Occupied Dwellings	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35. Finance, Ins. & Real Estate	1,396.23	12.70	94.17	957.82	8.71	64.60	438.41	3.99	29.57
36. Education & Health Services	22.13	(0.27)	1.85	15.29	(0.19)	1.29	6.84	(0.08)	0.57
37. Amusement & Recreation	19.06	(0.14)	1.41	13.07	(0.10)	0.97	5.98	(0.04)	0.44
38. Serv to Business Management	2,184.78	35.51	93.33	1,498.77	24.36	64.02	686.01	11.15	29.30
39. Accommodation & Food Serv	4.50	0.03	0.29	3.09	0.02	0.20	1.41	0.01	0.09
40. Other Personal & Misc. Serv.	88.42	0.52	5.36	60.66	0.36	3.68	27.76	0.16	1.68

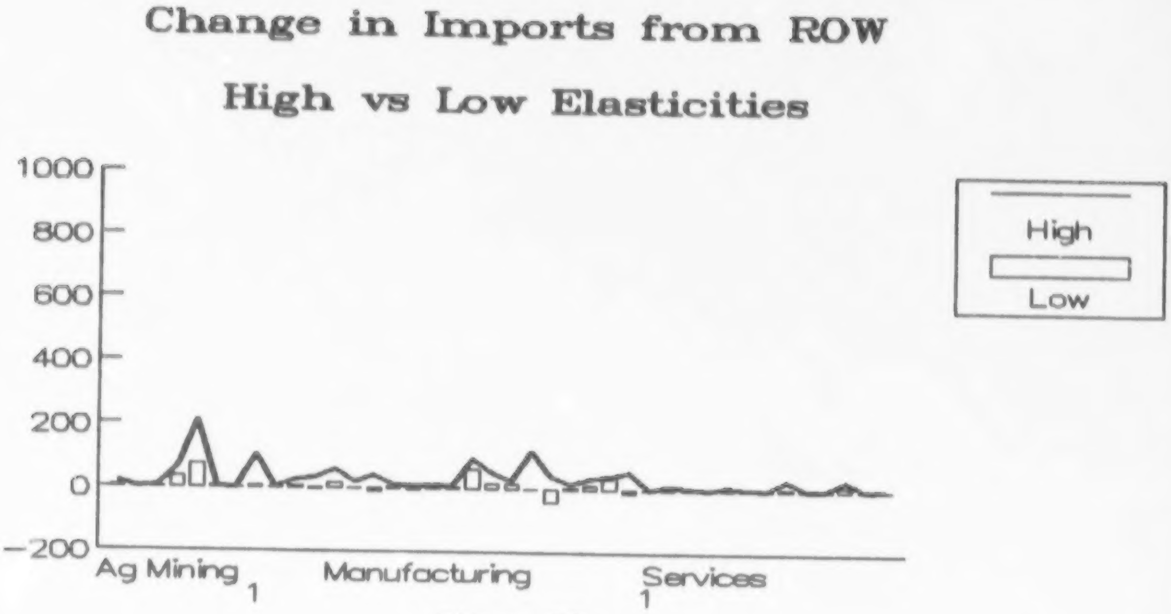

Change in Imports from ROW
High vs Low Elasticities

Figure 29

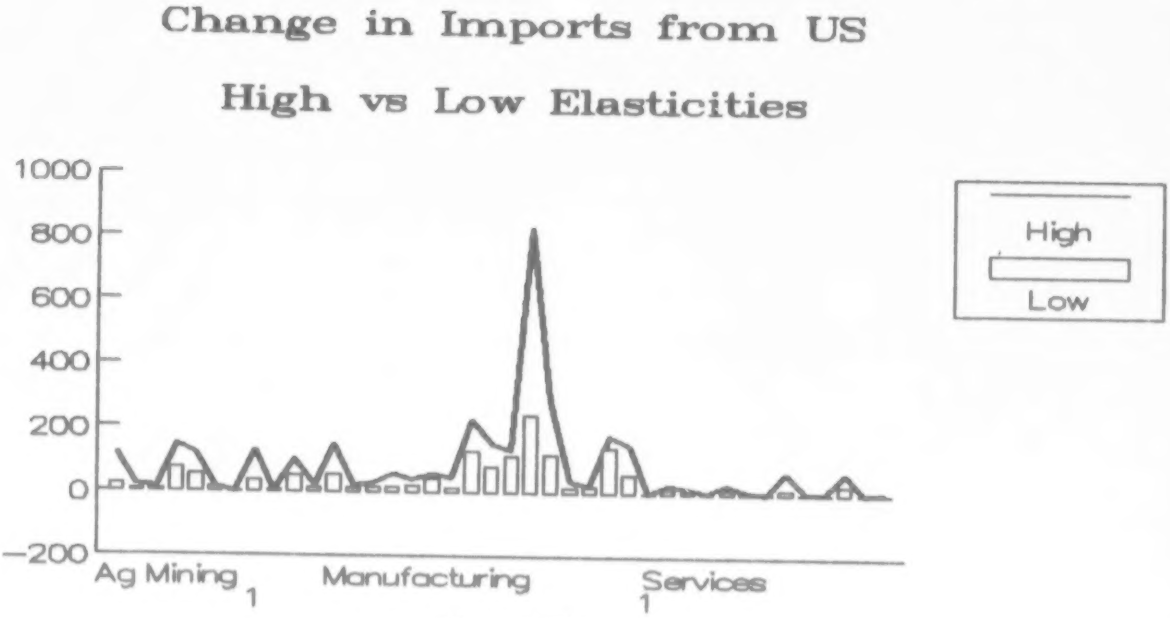

Change in Imports from US
High vs Low Elasticities

Figure 28

Imports from the United States

Changes in imports under the high and low elasticities cases are recorded by industry in Table 10 and displayed in figures 28 and 29. Figure 28 presents an overall picture for US imports under the high and low elasticities assumptions. US imports under the high elasticities assumption are shown by the solid line, imports under the low elasticities assumption are shown by the empty bars. From Figure 28 it can be seen that, in each industrial class, the increment of imports from the US after the agreement is greater under the high elasticities assumption than under the low elasticities assumption and, by referring to column 5 of Table 10, it can be verified that the increment of imports the under low elasticities assumption is positive in all cases except two service industries (36 and 37).

Although the amount imported is greater under the high than under the low elasticities assumption, the pattern is very much the same under either. The two cases differ because the terms of trade increase under the high elasticities assumption but fall under the low elasticities assumption. In either scenario increases are least in the service industries and greatest in the later stages of manufacturing.

Imports from the Rest of the World

Because of the improvement in Canada's terms of trade, total imports from the rest of the world are also greater in the high elasticities scenario. From Figure 29, the solid line indicates that this is true of all industrial categories. In the low elasticities scenario, total imports remain at about the same level as 1981 but, in Figure 29, we see from the bars that there are small increases and decreases across industries. The fall in Canada's terms of trade discourages imports but the higher level of GNE is an offsetting factor.

Imports and Domestic Supply - US and ROW

The competition generated from any given amount of imports depends on the size of the domestic industry. In order that this question might be considered, imports must be related to domestic supply. Table 11 and Figures 30 and 31 are presented for this purpose. Imports in each industrial class are divided by the total domestic supply in that category. Figure 30 shows the pattern of such ratios for US imports; Figure 31 shows the pattern for ROW imports. The ratio for each industry under the high elasticities assumption is shown as a dark line; the ratio for the low elasticities case is shown as bars. Whether we look at the import ratios for the US or ROW, similar patterns are produced under the high and low

TABLE 11

Ratio of Private Sector Imports by Industry from US and ROW to Base Year Output

		(1000) Output	Ratio for All Imports			Ratio for US Imports			Ratio for ROW Imports		
	Industry	1981 (1)	Base 1981 (2)	Elasticities: Low (3)	Elasticities: High (4)	Base 1981 (5)	Elasticities: Low (6)	Elasticities: High (7)	Base 1981 (8)	Elasticities: Low (9)	Elasticities: High (10)
1.	Agriculture	18,701	0.089	0.091	0.096	0.077	0.078	0.083	0.012	0.012	0.013
2.	Forestry	4,585	0.022	0.023	0.026	0.021	0.022	0.025	0.001	0.001	0.001
3.	Fishing, Hunting & Trapping	928	0.181	0.184	0.198	0.141	0.144	0.155	0.039	0.040	0.043
4.	Metal Mines	7,108	0.267	0.282	0.297	0.184	0.194	0.204	0.083	0.088	0.092
5.	Mineral Fuels	19,112	0.493	0.500	0.510	0.127	0.130	0.133	0.366	0.370	0.377
6.	Non-Metal Mines & Quarries	2,400	0.143	0.148	0.149	0.123	0.127	0.128	0.021	0.021	0.021
7.	Services Incidental to Mining	3,737	0.006	0.006	0.006	0.005	0.005	0.005	0.001	0.001	0.001
8.	Food & Beverage Industries	32,502	0.099	0.101	0.107	0.049	0.050	0.053	0.050	0.050	0.053
9.	Tobacco Products Industries	1,444	0.027	0.028	0.029	0.017	0.018	0.019	0.010	0.010	0.010
10.	Rubber & Plastics Products Ind	4,781	0.381	0.393	0.408	0.287	0.298	0.308	0.094	0.095	0.099
11.	Leather Industries	1,250	0.508	0.511	0.549	0.116	0.123	0.131	0.392	0.388	0.418
12.	Textile Industries	5,193	0.477	0.490	0.516	0.327	0.337	0.355	0.150	0.153	0.161
13.	Knitting Mills	946	0.455	0.463	0.496	0.148	0.158	0.168	0.307	0.306	0.328
14.	Clothing Industries	4,216	0.200	0.201	0.216	0.037	0.040	0.043	0.163	0.160	0.173
15.	Wood Industries	8,527	0.075	0.077	0.083	0.061	0.062	0.067	0.014	0.015	0.016
16.	Furniture & Fixture Industries	2,823	0.103	0.109	0.119	0.063	0.070	0.077	0.040	0.039	0.043
17.	Paper & Allied Industries	16,012	0.079	0.082	0.083	0.067	0.069	0.070	0.012	0.013	0.013
18.	Printing & Publishing	6,573	0.135	0.137	0.143	0.114	0.116	0.121	0.021	0.022	0.022
19.	Primary Metal Industries	18,001	0.239	0.250	0.257	0.156	0.163	0.168	0.084	0.087	0.089
20.	Metal Fabricating Industries	12,716	0.290	0.297	0.305	0.206	0.212	0.217	0.084	0.085	0.088
21.	Machinery Industries	9,202	0.401	0.415	0.418	0.327	0.339	0.341	0.074	0.076	0.077
22.	Transportation Equipment Ind.	22,823	0.527	0.538	0.569	0.450	0.461	0.487	0.077	0.077	0.082
23.	Electrical Products Industries	9,671	0.381	0.388	0.415	0.267	0.279	0.297	0.114	0.109	0.118
24.	Non-Metallic Mineral Prod Ind	4,888	0.198	0.202	0.209	0.143	0.146	0.150	0.056	0.056	0.059
25.	Petroleum & Coal Products Ind	20,792	0.062	0.064	0.065	0.027	0.028	0.028	0.035	0.036	0.037
26.	Chemical & Chemical Prod Ind	13,811	0.265	0.278	0.281	0.204	0.214	0.217	0.061	0.063	0.064
27.	Misc Manufacturing Industries	4,354	0.617	0.627	0.663	0.381	0.395	0.416	0.235	0.233	0.247
28.	Construction Industry	57,952	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29.	Transportation & Storage	28,019	0.029	0.029	0.030	0.020	0.020	0.021	0.009	0.009	0.009
30.	Communication	11,120	0.029	0.029	0.031	0.021	0.021	0.022	0.008	0.008	0.008
31.	Elec Power, Gas, & Other Ind	11,689	0.002	0.002	0.003	0.002	0.002	0.002	0.001	0.001	0.001
32.	Wholesale Trade	22,322	0.024	0.025	0.026	0.017	0.018	0.018	0.007	0.007	0.008
33.	Retail Trade	28,564	0.005	0.005	0.005	0.003	0.003	0.003	0.002	0.002	0.002
34.	Owner Occupied Dwellings	21,076	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35.	Finance, Ins. & Real Estate	44,326	0.031	0.032	0.034	0.022	0.022	0.023	0.010	0.010	0.011
36.	Education & Health Services	8,187	0.003	0.003	0.003	0.002	0.002	0.002	0.001	0.001	0.001
37.	Amusement & Recreation	3,250	0.006	0.006	0.006	0.004	0.004	0.004	0.002	0.002	0.002
38.	Serv to Business Management	16,105	0.136	0.138	0.141	0.093	0.095	0.097	0.043	0.043	0.044
39.	Accommodation & Food Serv	13,833	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40.	Other Personal & Misc. Serv.	4,120	0.021	0.022	0.023	0.015	0.015	0.016	0.007	0.007	0.007

Import to Output Ratio

US: High vs Low Elasticities

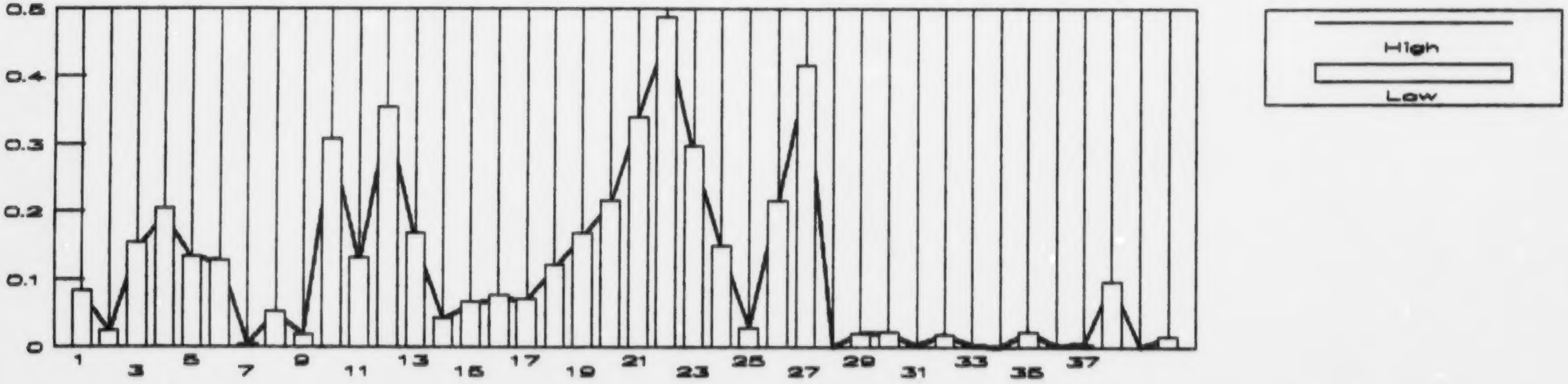


Figure 30

ROW: High vs Low Elasticities

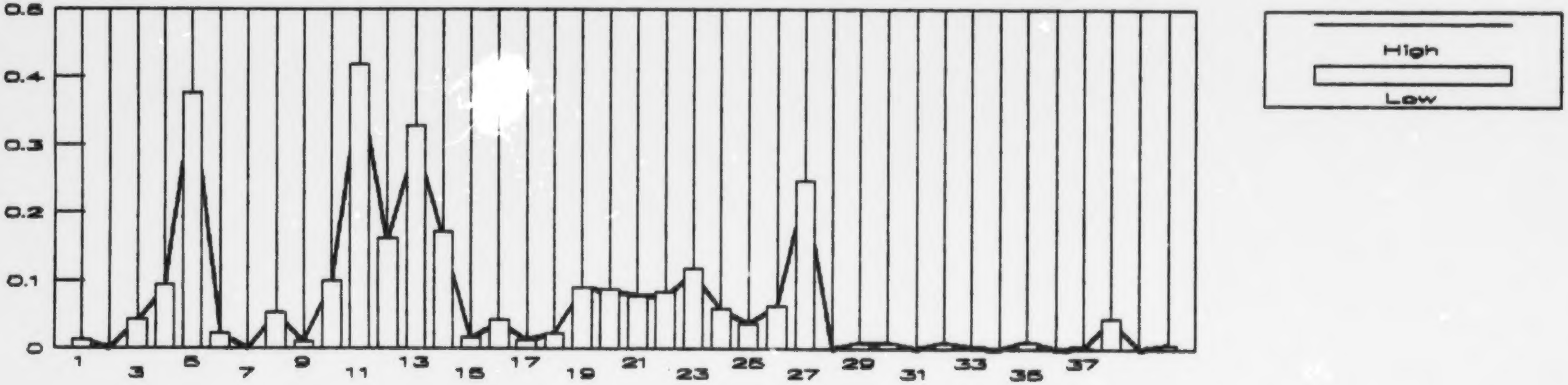


Figure 31

elasticity assumptions and these are similar to the pattern that would be produced by the reference period ratios. Under either the high or low elasticities assumption, imports by commodity are greater, but the pattern of import ratios is little affected by the agreement. This is confirmed by inspection of columns 3 and 4 of Table 11. The reader will find that under either the high or low elasticities assumptions, total imports either increase or do not change in every industrial category.

IMPORTS BY COMMODITY CLASSIFICATION

Commodity detail on imports is reported in Tables 12 and 13, whose layout is similar to that used to describe exports by commodity. Table 12 deals with imports from the US; Table 13 deals with imports from the ROW. Column 1 of Table 12 reports domestic supply. Columns 2, 3 and 4 respectively report imports from the US as they were in 1981 and as they would be under the high and low elasticities assumptions. The ratio of imports to domestic supply for the reference period, the high elasticities and low elasticities cases is shown in columns 5, 6 and 7. Columns 8, 9, 10 are used to make comparisons. In column 8, the import ratio in the reference period is subtracted from the ratio for the high elasticities case, in column 9 the ratio for the reference period is subtracted from the ratio obtained under the low elasticities assumption and in column 9 the difference between the ratio for the low elasticities case is subtracted from that for the high elasticities case. Table 13 presents the ROW data in the same format.

Commodity Imports from the United States

The ratios of imports from the US to total Canadian supply form the pattern shown in Figure 32 for the high elasticities case and in Figure 33 for the low elasticities case. The ratios increase in all categories under either assumption.

Details relating to commodity imports from the US are given in Table 12. Column 8 reports the ratio differences obtained under the high elasticities assumption. All are greater than the reference ratio. Column 9 lists the ratio difference for the low elasticities case. With the exception of four cases where the difference is less than -.0005, there are no commodities for which the ratio of imports to domestic supply is significantly greater in the reference period. Column 10 confirms that the high elasticities assumption leads to greater imports. There are only 6 commodity classes where the low elasticities assumption leads to a higher ratio than the high elasticities assumption. In all six of these cases the ratio difference is, numerically, .002 or less. In both the high and low elasticities case, imports are stimulated because of the liberalization of trade between Canada and the US and

TABLE 12

Commodity Imports from US Compared to Domestic Supply under Various Scenarios

	Domestic Supply	Change in the Level of Imports from US			US Imports per Unit of Domestic Supply			US Imports per Unit Ratio Differences		
			Elasticities:			Elasticities:				
Commodity	1981 (1000) (1)	1981 (1000) (2)	High (3)	Low (4)	Base 1981 (5)	High (6)	Low (7)	High Less Ref (8)	Low Less Ref (9)	High Less Low (10)
1. Grains	6,226	225	243	229	0.036	0.039	0.037	0.003	0.001	0.002
2. Live Animals	5,845	199	215	202	0.034	0.037	0.035	0.003	0.001	0.002
3. Other Agricultural Products	6,340	1,019	1,102	1,036	0.161	0.174	0.163	0.013	0.003	0.011
4. Forestry Products	4,643	92	111	96	0.020	0.024	0.021	0.004	0.001	0.003
5. Fish Landings	845	36	38	36	0.042	0.046	0.043	0.003	0.001	0.003
6. Hunting & Trapping Products	72	95	104	97	1.319	1.451	1.350	0.132	0.031	0.101
7. Iron Ores & Concentrates	1,653	309	347	328	0.187	0.210	0.198	0.023	0.011	0.012
8. Other Metal Ores & Concentrates	6,255	1,193	1,324	1,259	0.191	0.212	0.201	0.021	0.011	0.010
9. Coal	906	1,010	1,084	1,041	1.115	1.197	1.149	0.082	0.034	0.048
10. Crude Mineral Oils	10,245	1,205	1,242	1,218	0.118	0.121	0.119	0.004	0.001	0.002
11. Natural Gas	5,992	1	1	1	0.000	0.000	0.000	0.000	0.000	0.000
12. Non-Metallic Minerals	1,829	303	315	316	0.166	0.172	0.173	0.007	0.007	-0.001
13. Services Incidental to Mining	3,937	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
14. Meat Products	9,736	227	244	230	0.023	0.025	0.024	0.002	0.000	0.001
15. Dairy Products	4,573	12	14	13	0.003	0.003	0.003	0.000	0.000	0.000
16. Fish Products	1,550	172	183	173	0.111	0.118	0.112	0.007	0.001	0.006
17. Fruits & Vegetables Preps.	2,076	343	374	352	0.165	0.180	0.170	0.015	0.004	0.011
18. Feeds	3,063	198	209	200	0.064	0.068	0.065	0.004	0.001	0.003
19. Flour, Wheat, Meal & Cereals	760	17	19	18	0.023	0.025	0.023	0.002	0.000	0.001
20. B'fast Cereal & Bakery Prods.	2,261	44	49	46	0.019	0.022	0.020	0.002	0.001	0.001
21. Sugar	830	7	7	7	0.008	0.009	0.008	0.001	0.000	0.000
22. Misc. Food Products	3,874	437	477	448	0.113	0.123	0.116	0.010	0.003	0.007
23. Soft Drinks	1,246	12	14	13	0.010	0.011	0.010	0.001	0.001	0.001
24. Alcoholic Beverages	2,334	75	81	77	0.032	0.035	0.033	0.003	0.001	0.002
25. Tobacco Processed Unmanufactured	356	6	7	6	0.017	0.018	0.017	0.001	0.000	0.001
26. Cigarettes & Tobacco Mfg.	1,068	16	18	17	0.015	0.017	0.016	0.002	0.001	0.001
27. Tires & Tubes	1,202	184	199	191	0.153	0.165	0.159	0.012	0.006	0.006
28. Other Rubber Products	640	156	170	164	0.243	0.265	0.256	0.022	0.013	0.010
29. Plastic Fabricated Products	2,111	602	638	621	0.285	0.302	0.294	0.017	0.009	0.008
30. Leather & Leather Products	1,091	104	119	111	0.095	0.109	0.102	0.014	0.007	0.007
31. Yarns & Man Made Fibres	1,118	324	349	333	0.290	0.312	0.297	0.022	0.008	0.014
32. Fabrics	1,735	514	568	534	0.296	0.327	0.308	0.031	0.012	0.019
33. Other Textile Products	1,848	272	294	277	0.147	0.159	0.150	0.011	0.003	0.009
34. Hosiery & Knitted Wear	971	41	52	48	0.042	0.054	0.050	0.012	0.008	0.004
35. Clothing & Accessories	3,949	142	166	155	0.036	0.042	0.039	0.006	0.003	0.003
36. Lumber & Timber	3,953	289	329	296	0.073	0.083	0.075	0.010	0.002	0.008
37. Veneer & Plywood	809	77	85	78	0.095	0.105	0.097	0.010	0.002	0.008
38. Other Wood Fab. Materials	3,754	147	153	152	0.039	0.041	0.040	0.002	0.001	0.000
39. Furniture & Fixtures	2,815	153	192	173	0.054	0.068	0.062	0.014	0.007	0.006
40. Pulp	4,080	52	53	56	0.013	0.013	0.014	0.000	0.001	-0.001
41. Newsprint & Other Paper Stock	7,471	405	418	423	0.054	0.056	0.057	0.002	0.002	-0.001
42. Paper Products	4,374	513	549	529	0.117	0.126	0.121	0.008	0.003	0.005
43. Printing & Publishing	4,549	731	775	742	0.161	0.170	0.163	0.010	0.002	0.007
44. Advertising, Print Media	1,816	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000

Continued next page

TABLE 12 (Continued)
Commodity Imports from US Compared to Domestic Supply under Various Scenarios

	Domestic Supply	Change in the Level of Imports from US			US Imports per Unit of Domestic Supply			US Imports per Unit Ratio Differences		
	1981 (1000)	1981 (1000)	Elasticities:		Base 1981	Elasticities:		High Less Ref	Low Less Ref	High Less Low
Commodity			High	Low		High	Low			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
45. Iron & Steel Products	8,467	912	956	945	0.108	0.113	0.112	0.005	0.004	0.001
46. Aluminum Products	2,997	386	421	405	0.129	0.140	0.135	0.012	0.006	0.005
47. Copper & Copper Alloy Products	1,704	144	161	152	0.085	0.095	0.089	0.010	0.004	0.005
48. Nickel Products	1,206	70	75	73	0.058	0.062	0.060	0.004	0.003	0.002
49. Other Non-Ferrous Metal Prods.	2,270	1,008	1,118	1,064	0.444	0.493	0.469	0.049	0.025	0.024
50. Boilers, Tanks & Plates	881	76	77	77	0.086	0.088	0.087	0.002	0.001	0.000
51. Fab. Structural Metal Prod.	2,823	99	100	100	0.035	0.036	0.035	0.001	0.000	0.000
52. Other Metal Fab. Products	7,534	1,771	1,863	1,820	0.235	0.247	0.242	0.012	0.007	0.006
53. Agricultural Machinery	1,417	360	372	371	0.254	0.263	0.262	0.009	0.008	0.001
54. Other Industrial Machinery	7,851	3,034	3,142	3,153	0.386	0.400	0.402	0.014	0.015	-0.001
55. Motor Vehicles	12,015	3,141	3,401	3,140	0.261	0.283	0.261	0.022	-0.000	0.022
56. Motor Vehicle Parts	5,945	7,793	8,432	8,061	1.311	1.418	1.356	0.107	0.045	0.062
57. Other Transport Equipment	5,238	809	861	831	0.154	0.164	0.159	0.010	0.004	0.006
58. Appliances & Receivers, H'hold	1,715	896	1,076	970	0.523	0.628	0.566	0.105	0.043	0.062
59. Other Electrical Products	8,294	1,805	1,947	1,861	0.218	0.235	0.224	0.017	0.007	0.010
60. Cement & Concrete Products	2,382	63	65	64	0.027	0.027	0.027	0.001	0.000	0.000
61. Other Non-Metal. Mineral Prod.	2,428	646	681	661	0.266	0.280	0.272	0.014	0.006	0.008
62. Gasoline & Fuel Oil	16,684	120	125	121	0.007	0.008	0.007	0.000	0.000	0.000
63. Other Petroleum & Coal Prods.	5,236	470	487	488	0.090	0.093	0.093	0.003	0.003	-0.000
64. Industrial Chemicals	7,648	1,708	1,799	1,811	0.223	0.235	0.237	0.012	0.013	-0.002
65. Fertilizers	1,326	96	101	98	0.073	0.076	0.074	0.003	0.002	0.002
66. Pharmaceuticals	1,331	142	151	146	0.107	0.114	0.110	0.007	0.003	0.004
67. Other Chemical Products	4,780	1,171	1,261	1,218	0.245	0.264	0.255	0.019	0.010	0.009
68. Scientific Equipment	1,527	1,130	1,227	1,164	0.740	0.804	0.763	0.064	0.023	0.041
69. Other Manufactured Products	3,030	868	948	899	0.287	0.313	0.297	0.026	0.010	0.016
70. Residential Construction	13,193	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
71. Non-Residential Construction	34,723	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
72. Repair Construction	9,674	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
73. Pipeline Transportation	2,056	205	213	211	0.100	0.104	0.103	0.004	0.003	0.001
74. Transportation & Storage	25,097	280	291	284	0.011	0.012	0.011	0.000	0.000	0.000
75. Radio & TV Broadcasting	1,592	19	20	19	0.012	0.013	0.012	0.001	0.000	0.001
76. Telephone & Telegraph	7,420	108	114	108	0.014	0.015	0.015	0.001	0.000	0.001
77. Postal Services	1,514	7	7	7	0.004	0.005	0.004	0.000	0.000	0.000
78. Electric Power	9,847	8	9	8	0.001	0.001	0.001	0.000	0.000	0.000
79. Other Utilities	1,581	1	2	1	0.001	0.001	0.001	0.000	0.000	0.000
80. Wholesale Margins	24,142	196	206	201	0.008	0.009	0.008	0.000	0.000	0.000
81. Retail Margins	23,413	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
82. Imputed Rent Owner Ocpd. Dwel.	21,077	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
83. Other Fin., Ins., Real Estate.	44,415	962	1,028	971	0.022	0.023	0.022	0.001	0.000	0.001
84. Business Services	13,741	1,510	1,574	1,535	0.110	0.115	0.112	0.005	0.002	0.003
85. Education Services	894	15	16	15	0.017	0.018	0.016	0.001	-0.000	0.002
86. Health Services	7,286	0	0	0	0.000	0.000	0.000	0.000	-0.000	0.000
87. Amusement & Recr. Services	3,051	12	13	12	0.004	0.004	0.004	0.000	-0.000	0.000
88. Accommodation & Food Services	14,426	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
89. Other Personal & Misc. Servs.	14,984	223	237	225	0.015	0.016	0.015	0.001	0.000	0.001
90. Transportation Margins	10,935	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000

US Imports Per $ of Supply

High Elasticities Less Reference Year

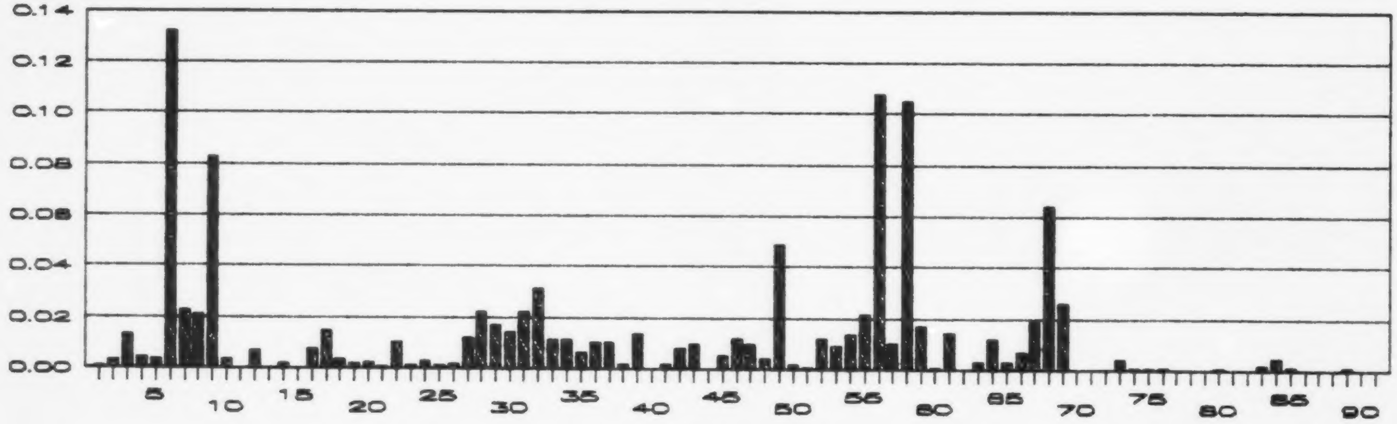


Figure 32

Low Elasticities Less Reference Year

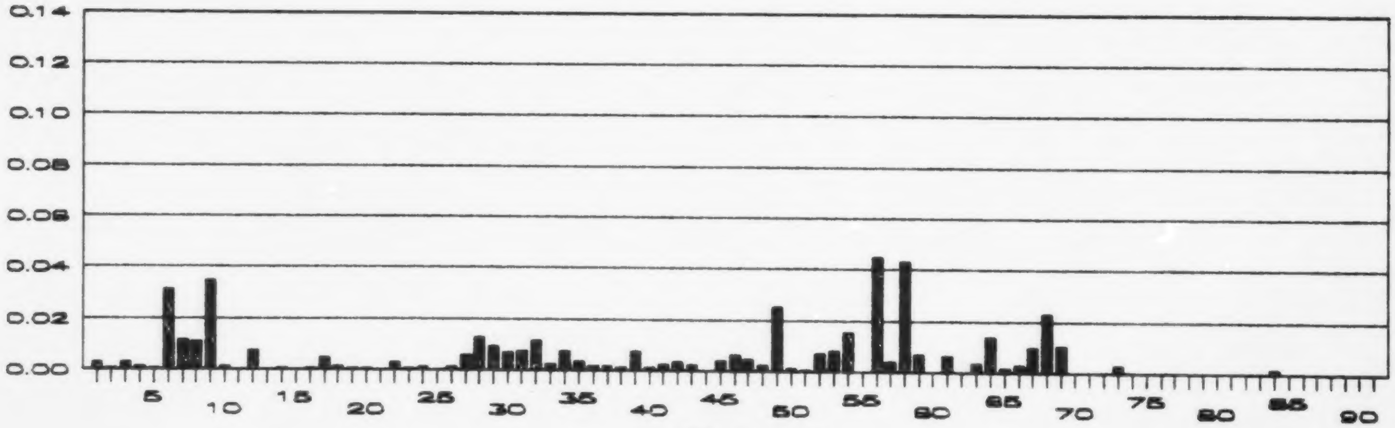


Figure 33

the higher level of GNE in Canada. In the high elasticities case, greater imports are attracted because Canada's terms of trade improve. The pattern of US import ratios is similar under the high and low elasticities assumptions.

Commodity Imports from the Rest of the World

Figures 34 and 35 show the pattern of import ratios for the ROW for the high and low elasticities cases. The ratios are greater in the high elasticities case because Canada's terms of trade improve. Details are shown in Table 13. Column 8 shows the difference between the ratio under the high elasticity assumption and the 1981 reference year. Import ratios for tires, tobacco, rubber products and textiles (27, 28, 30 - 32) are relatively large, as are Alcoholic Beverages (24) and certain primary commodities: Hunting & Trapping Products (6), Other Metal Ores & Concentrates ((8) and Crude Mineral Oils (10). Two categories show large declines: Appliances & Receivers (58) and Scientific Equipment (68). Under the low elasticities assumption Canada's terms of trade fall, imports cost more and we find the ratio for most categories of imports is lower. Appliances & Receivers, Households (58), Scientific Equipment (68) and Other Manufactured Products (69) are notable exceptions.

TABLE 13

Commodity Imports from ROW Compared to Domestic Supply under Various Scenarios

	Domestic Supply	Change in the Level of Imports from ROW			ROW Imports per Unit of Domestic Supply			ROW Imports per Unit Ratio Differences		
Commodity	1981 (1000) (1)	1981 (1000) (2)	Elasticities: High (3)	Low (4)	Base 1981 (5)	Elasticities: High (6)	Low (7)	High Less Ref (8)	Low Less Ref (9)	High Less Low (10)
1. Grains	6,226	0	1	0	0.000	0.000	0.000	0.000	0.000	0.000
2. Live Animals	5,845	6	7	7	0.001	0.001	0.001	0.000	0.000	0.000
3. Other Agricultural Products	6,340	215	231	217	0.034	0.036	0.034	0.002	0.000	0.002
4. Forestry Products	4,643	1	2	1	0.000	0.000	0.000	0.000	0.000	0.000
5. Fish Landings	845	14	15	14	0.016	0.018	0.017	0.001	0.000	0.001
6. Hunting & Trapping Products	72	22	24	22	0.305	0.336	0.312	0.031	0.007	0.023
7. Iron Ores & Concentrates	1,653	8	9	9	0.005	0.006	0.005	0.001	0.000	0.000
8. Other Metal Ores & Concentrates	6,255	705	783	744	0.113	0.125	0.119	0.012	0.006	0.006
9. Coal	906	2	2	2	0.002	0.002	0.002	0.000	-0.000	0.000
10. Crude Mineral Oils	10,245	7,020	7,232	7,091	0.685	0.706	0.692	0.021	0.007	0.014
11. Natural Gas	5,992	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
12. Non-Metallic Minerals	1,829	62	65	65	0.034	0.035	0.035	0.001	0.001	-0.000
13. Services Incidental to Mining	3,937	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
14. Meat Products	9,736	216	230	216	0.022	0.024	0.022	0.001	0.000	0.001
15. Dairy Products	4,573	89	95	89	0.019	0.021	0.019	0.001	-0.000	0.001
16. Fish Products	1,550	161	171	162	0.104	0.110	0.105	0.007	0.001	0.006
17. Fruits & Vegetables Preps.	2,076	324	345	324	0.156	0.166	0.156	0.010	0.000	0.010
18. Feeds	3,063	8	9	8	0.003	0.003	0.003	0.000	-0.000	0.000
19. Flour, Wheat, Meal & Cereals	760	7	8	8	0.010	0.010	0.010	0.001	0.000	0.001
20. B'fast Cereal & Bakery Prods.	2,261	27	29	27	0.012	0.013	0.012	0.001	-0.000	0.001
21. Sugar	830	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
22. Misc. Food Products	3,874	381	406	380	0.098	0.105	0.098	0.006	-0.000	0.007
23. Soft Drinks	1,246	8	8	8	0.006	0.007	0.006	0.000	-0.000	0.000
24. Alcoholic Beverages	2,334	418	443	421	0.179	0.190	0.180	0.011	0.001	0.010
25. Tobacco Processed Unmanufactured	356	2	2	2	0.006	0.006	0.006	0.000	0.000	0.000
26. Cigarettes & Tobacco Mfg.	1,068	10	11	10	0.010	0.010	0.010	0.001	-0.000	0.001
27. Tires & Tubes	1,202	189	200	192	0.157	0.166	0.160	0.009	0.003	0.006
28. Other Rubber Products	640	92	98	92	0.143	0.153	0.144	0.009	0.001	0.008
29. Plastic Fabricated Products	2,111	82	87	84	0.039	0.041	0.040	0.002	0.001	0.001
30. Leather & Leather Products	1,091	484	516	478	0.443	0.473	0.438	0.029	-0.005	0.034
31. Yarns & Man Made Fibres	1,118	182	195	186	0.163	0.175	0.167	0.012	0.004	0.008
32. Fabrics	1,735	412	448	423	0.237	0.258	0.244	0.021	0.006	0.014
33. Other Textile Products	1,848	200	211	201	0.108	0.114	0.109	0.006	0.001	0.005
34. Hosiery & Knitted Wear	971	314	332	308	0.323	0.342	0.317	0.019	-0.006	0.025
35. Clothing & Accessories	3,949	602	637	592	0.153	0.161	0.150	0.009	-0.003	0.011
36. Lumber & Timber	3,953	27	30	27	0.007	0.008	0.007	0.001	0.000	0.001
37. Veneer & Plywood	809	56	61	57	0.069	0.076	0.070	0.007	0.001	0.006
38. Other Wood Fab. Materials	3,754	34	36	35	0.009	0.010	0.009	0.000	0.000	0.000
39. Furniture & Fixtures	2,815	106	114	103	0.038	0.040	0.036	0.003	-0.001	0.004
40. Pulp	4,080	33	33	35	0.008	0.008	0.009	0.000	0.001	-0.000
41. Newsprint & Other Paper Stock	7,471	22	23	23	0.003	0.003	0.003	0.000	0.000	-0.000
42. Paper Products	4,374	116	122	119	0.026	0.028	0.027	0.002	0.001	0.001
43. Printing & Publishing	4,549	131	138	133	0.029	0.030	0.029	0.002	0.000	0.001
44. Advertising, Print Media	1,816	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
		0	0	0						

Continued next page

TABLE 13 (Continued)
Commodity Imports from ROW Compared to Domestic Supply under Various Scenarios

	Domestic Supply	Change in the Level of Imports from ROW			ROW Imports per Unit of Domestic Supply			ROW Imports per Unit Ratio Differences		
Commodity	1981 (1000) (1)	1981 (1000) (2)	Elasticities: High (3)	Low (4)	Base 1981 (5)	Elasticities: High (6)	Low (7)	High Less Ref (8)	Low Less Ref (9)	High Less Low (10)
45. Iron & Steel Products	8,467	1,113	1,167	1,154	0.131	0.138	0.136	0.006	0.005	0.002
46. Aluminum Products	2,997	57	62	60	0.019	0.021	0.020	0.001	0.001	0.001
47. Copper & Copper Alloy Products	1,704	57	63	60	0.033	0.037	0.035	0.002	0.002	0.002
48. Nickel Products	1,206	39	42	41	0.032	0.035	0.034	0.001	0.001	0.001
49. Other Non-Ferrous Metal Prods.	2,270	147	163	156	0.065	0.072	0.069	0.004	0.004	0.004
50. Boilers, Tanks & Plates	881	19	19	19	0.021	0.022	0.022	0.000	0.000	0.000
51. Fab. Structural Metal Prod.	2,823	152	154	153	0.054	0.055	0.054	0.000	0.000	0.000
52. Other Metal Fab. Products	7,534	636	666	649	0.084	0.088	0.086	0.002	0.002	0.002
53. Agricultural Machinery	1,417	36	37	38	0.026	0.026	0.027	0.001	-0.000	-0.000
54. Other Industrial Machinery	7,851	642	664	666	0.082	0.085	0.085	0.003	-0.000	-0.000
55. Motor Vehicles	12,015	1,102	1,179	1,091	0.092	0.098	0.091	-0.001	0.007	0.007
56. Motor Vehicle Parts	5,945	543	578	550	0.091	0.097	0.092	0.001	0.005	0.005
57. Other Transport Equipment	5,238	207	220	211	0.039	0.042	0.040	0.001	0.002	0.002
58. Appliances & Receivers, H'hold	1,715	807	820	745	0.471	0.478	0.434	-0.036	0.044	0.044
59. Other Electrical Products	8,294	415	443	423	0.050	0.053	0.051	0.001	0.002	0.002
60. Cement & Concrete Products	2,382	1	2	1	0.001	0.001	0.001	0.000	0.000	0.000
61. Other Non-Metal. Mineral Prod.	2,428	282	297	283	0.116	0.122	0.116	0.000	0.006	0.006
62. Gasoline & Fuel Oil	16,684	588	615	594	0.035	0.037	0.036	0.000	0.001	0.001
63. Other Petroleum & Coal Prods.	5,236	73	75	76	0.014	0.014	0.014	0.000	-0.000	-0.000
64. Industrial Chemicals	7,648	460	485	488	0.060	0.063	0.064	0.004	-0.000	-0.000
65. Fertilizers	1,326	5	6	5	0.004	0.004	0.004	-0.000	0.000	0.000
66. Pharmaceuticals	1,331	167	174	172	0.126	0.131	0.129	0.003	0.002	0.002
67. Other Chemical Products	4,780	253	265	255	0.053	0.055	0.053	0.000	0.002	0.002
68. Scientific Equipment	1,527	595	620	579	0.390	0.406	0.379	-0.011	0.027	0.027
69. Other Manufactured Products	3,030	728	771	730	0.240	0.254	0.241	0.001	0.014	0.014
70. Residential Construction	13,193	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
71. Non-Residential Construction	34,723	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
72. Repair Construction	9,674	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
73. Pipeline Transportation	2,056	94	98	97	0.046	0.048	0.047	0.001	0.001	0.001
74. Transportation & Storage	25,097	128	133	130	0.005	0.005	0.005	0.000	0.000	0.000
75. Radio & TV Broadcasting	1,592	9	9	9	0.006	0.006	0.006	0.000	0.000	0.000
76. Telephone & Telegraph	7,420	49	52	49	0.007	0.007	0.007	0.000	0.000	0.000
77. Postal Services	1,514	3	3	3	0.002	0.002	0.002	0.000	0.000	0.000
78. Electric Power	9,847	1	1	1	0.000	0.000	0.000	-0.000	0.000	0.000
79. Other Utilities	1,581	1	1	1	0.000	0.000	0.000	0.000	0.000	0.000
80. Wholesale Margins	24,142	90	94	92	0.004	0.004	0.004	0.000	0.000	0.000
81. Retail Margins	23,413	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
82. Imputed Rent Owner Ocpd. Dwel.	21,077	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
83. Other Fin., Ins., Real Estate.	44,415	440	470	444	0.010	0.011	0.010	0.000	0.001	0.001
84. Business Services	13,741	691	720	702	0.050	0.052	0.051	0.001	0.001	0.001
85. Education Services	894	7	7	7	0.008	0.008	0.007	-0.000	0.001	0.001
86. Health Services	7,286	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
87. Amusement & Recr. Services	3,051	6	6	6	0.002	0.002	0.002	-0.000	0.000	0.000
88. Accommodation & Food Services	14,426	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
89. Other Personal & Misc. Servs.	14,984	102	108	103	0.007	0.007	0.007	0.000	0.000	0.000
90. Transportation Margins	10,935	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000

ROW Imports Per $ of Supply

High Elasticities Less Reference Year

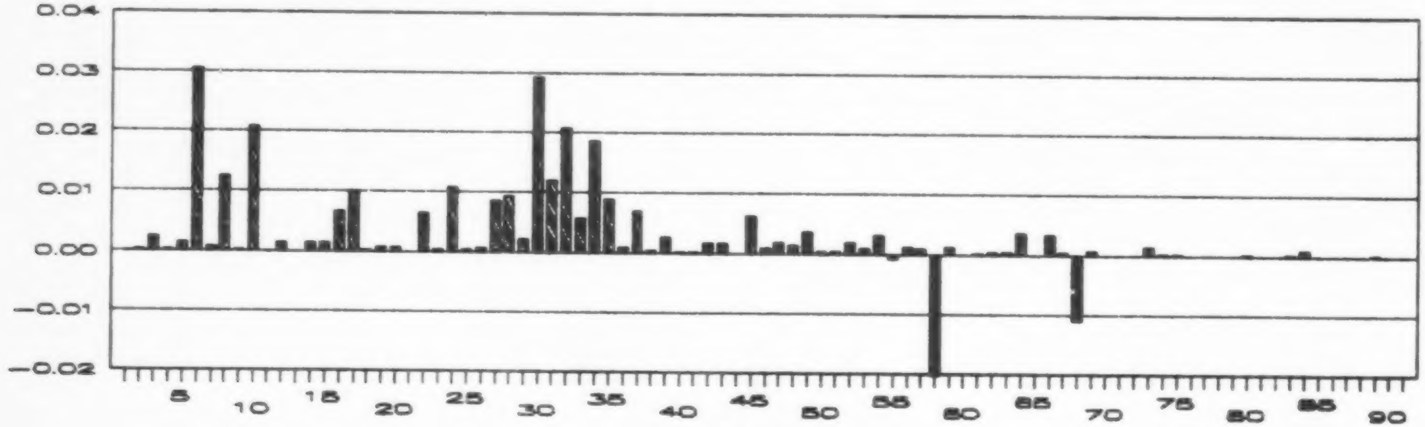


Figure 34

Low Elasticities Less Reference Year

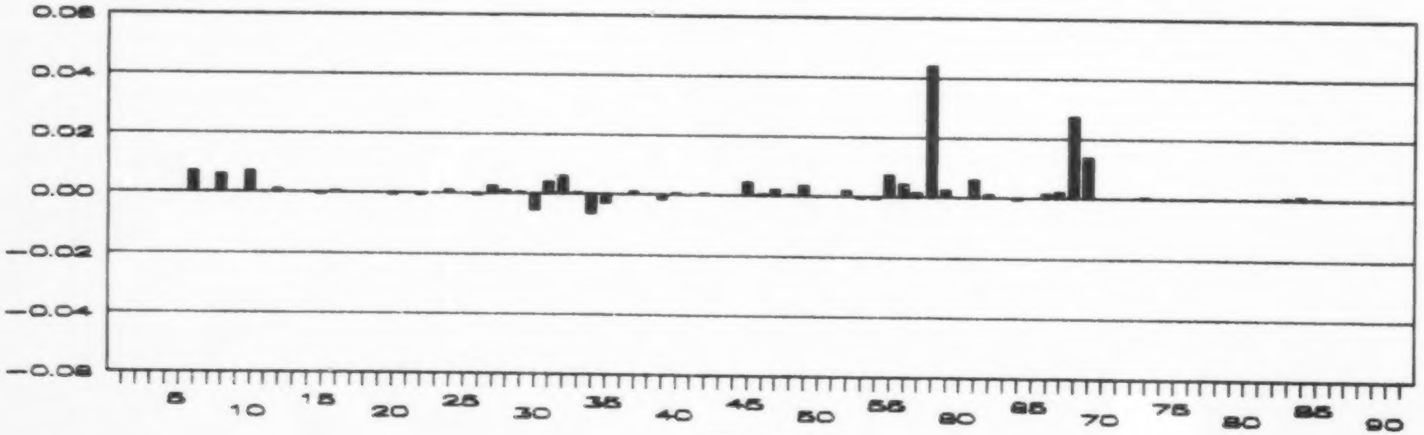


Figure 35

Total Commodity Imports

The ratios of imports from both US and ROW show very little change because imports are not a large proportion of domestic supply in any commodity category. Figures 36 and 37 show the sum of the US and ROW changes. In Figure 36 the dark line represents the ratios in the 1981 reference period and the bar the ratios under the high elasticities assumption. Figure 37 compares the reference year to the low elasticities scenario. Under both the high and low elasticities assumption the imports in each category are usually greater than in the reference period but the profiles of ratios are very much the same in all three cases.

NET EXPORTS AND DOMESTIC CONSUMPTION

In the sections above, we found that both imports and exports increase within most industrial classifications. This is consistent with the rationale for free trade which holds that the gains from trade arise from specialization in production at the level of the firm. Both nations will specialize within the same industry classifications, narrowing product lines and meeting the consumers' demand for variety through international trade. Nevertheless, the trade results suggest that there will be some shift in production between

Total Imports Per $ of Supply

High Elasticities

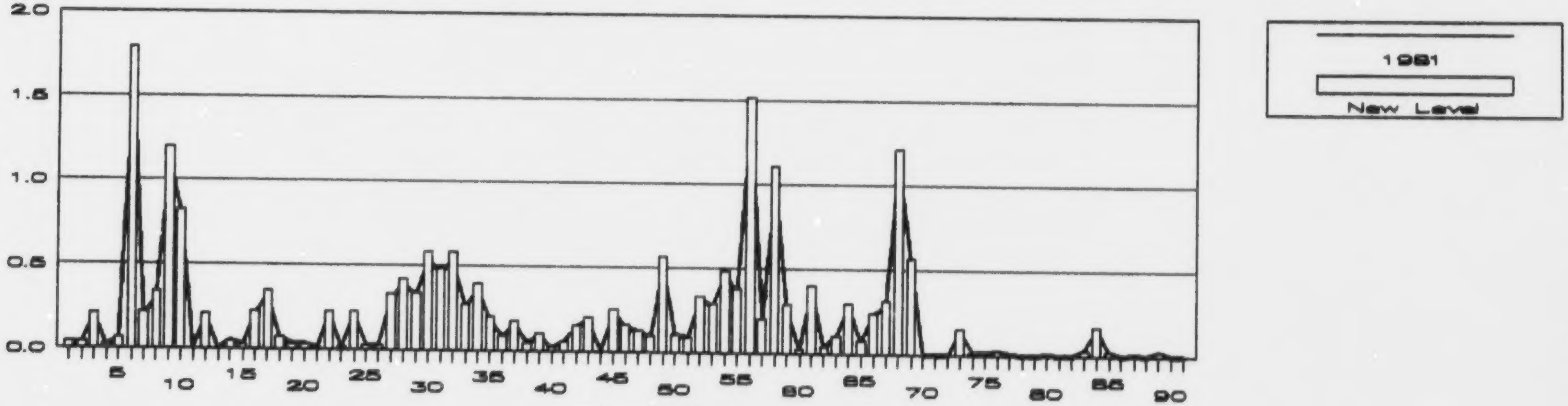


Figure 36

Low Elasticities

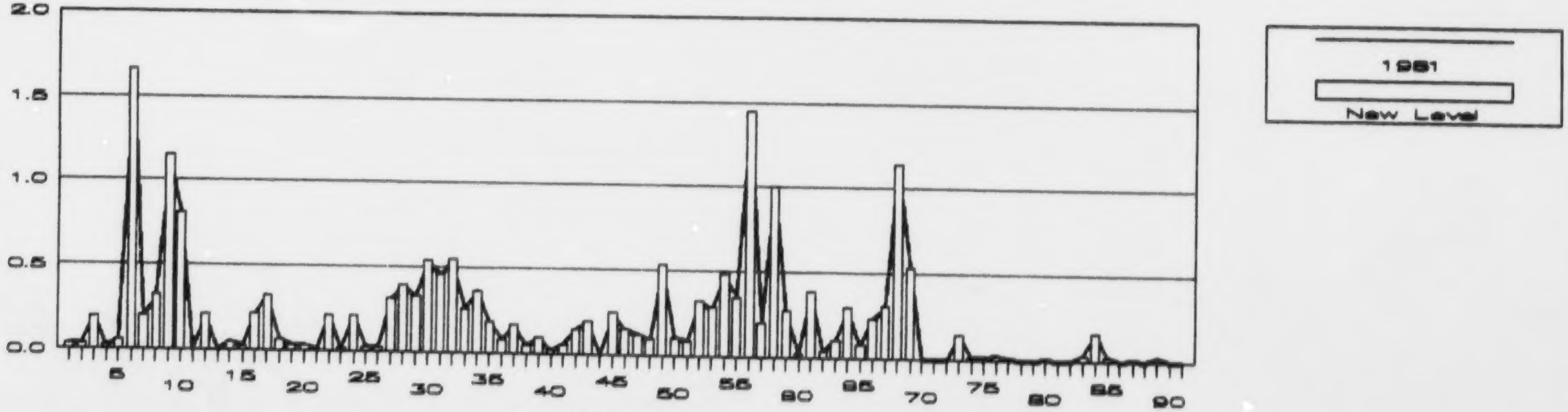


Figure 37

industries. Figures 38 and 39 are constructed in order to investigate this factor.

In Figure 38 imports of the private sector are subtracted from Canadian exports. Since imports of the government are excluded, the figure shows more net exports than we expect. However, government demand for imports is an assumed constant and the same constant amount is deducted in each industry under either the high or low elasticities assumption; therefore the figure accurately shows the pattern of change in net exports. Wherever there is a significant change in net exports the direction is the same under the high and low elasticities assumptions. Similarly, wherever the export ratio less the import ratio is positive for the high elasticities case, it is also for the low elasticities case. The pattern of net exports is insensitive to our assumptions concerning elasticities. Tariff changes, changes in NTBs, the changes in government procurement rules and the cost changes through economies of scale dominate the pattern of change in net exports. This conclusion is corroborated if we consider the ratios of net exports to domestic production shown in Figure 39. Only in cases where these ratios are very small is there a difference in sign under the high and low elasticities.

However, net exports do not determine the level of production; Canada is its own best customer. Under the agreement,

Exports Less Private Sector Imports
High vs Low Elasticities

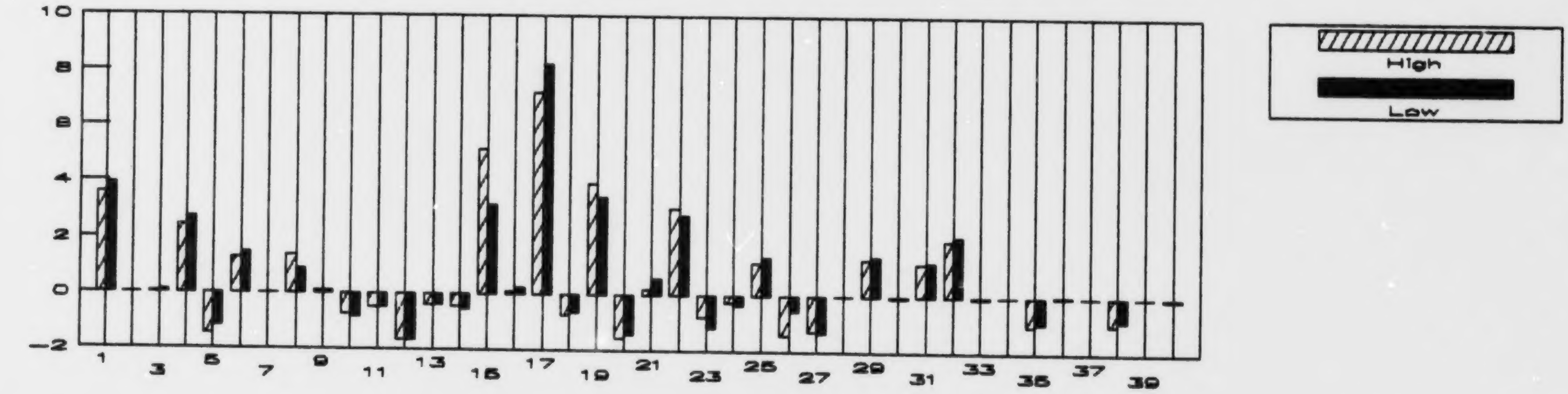


Figure 38

Export Ratio Less Import Ratio:
High vs Low Elasticities

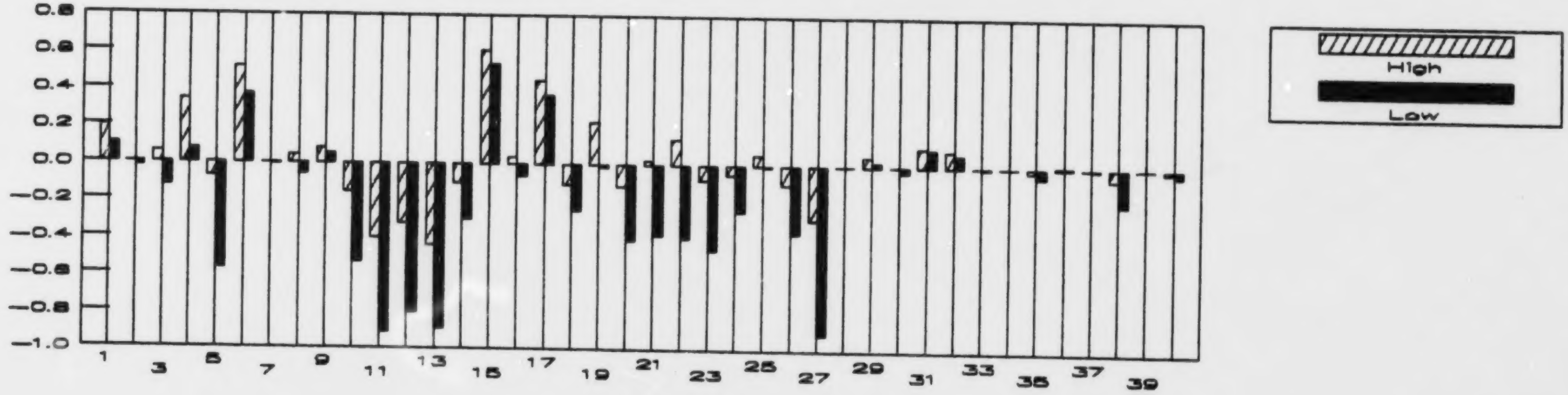


Figure 39

Ratio: Consumption to Domestic Output

High vs Low Elasticities Ratios

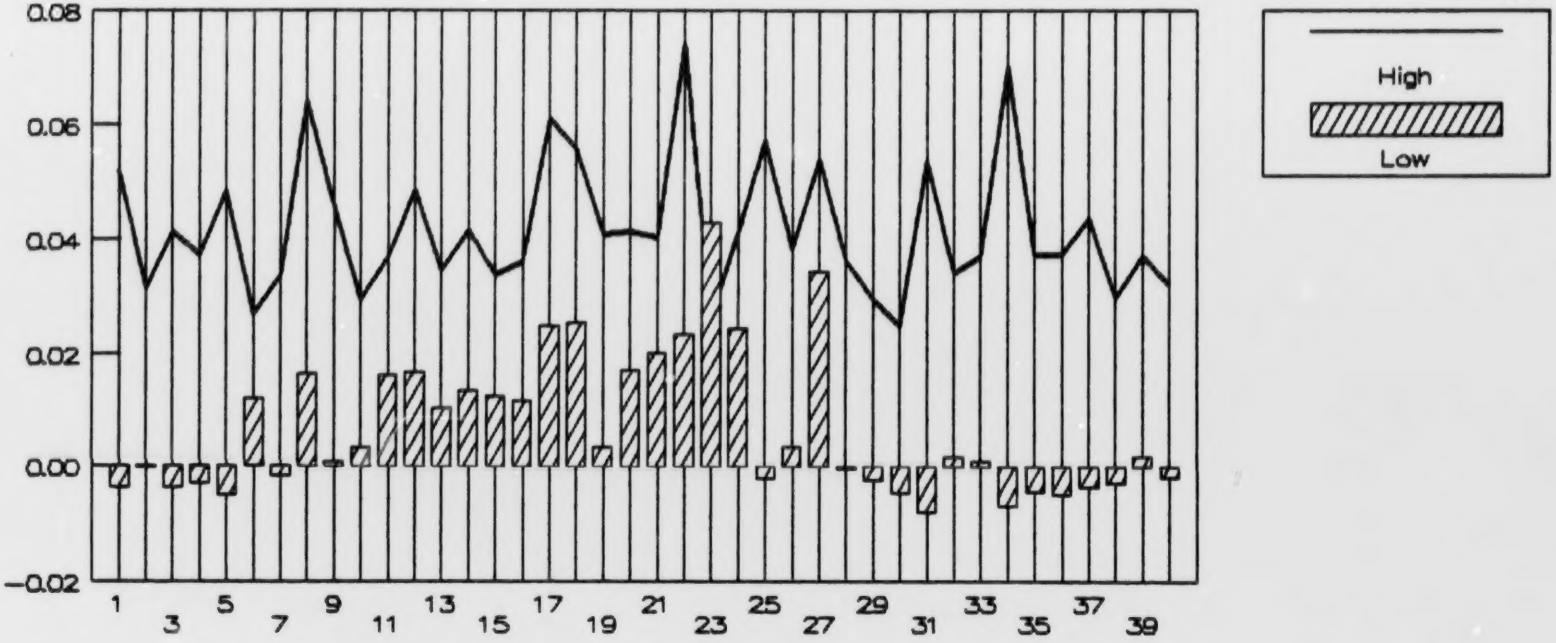


Figure 40

imported goods from the US become cheaper and there is a tendency to consume less of similar goods produced domestically and more of those imported from the US. On the other hand, with the rise in Canada's national income, we expect purchases of domestically produced goods will increase. In Figure 40 we show the ratio of consumption to 1981 domestic output. Under the low elasticities assumption, Canada's national income rises only .25 percent and substitution of imported for domestic goods is found in many industrial categories. There is an increase in demand for manufactured goods but declines in almost all other sectors. The details are reported in Table 14. Under the high elasticities assumption, national income rises by 4 percent and there is an increase in demand in all categories.

In order that we might report values of all variables generated by our model, we have added columns 8 and 9 to Table 14. These columns show the average cost by industry under the high and low elasticities assumptions. Prices in manufacturing are generally lower after the agreement and prices outside manufacturing are greater.

CONCLUSION

Whether we look at trade in terms of the industrial or commodity classification, under either the high or low elasticities assumption both imports and exports of manufactured goods increase. On the export side, this was caused predominantly by increased trade with the United States. When exports by commodity were examined, we also observed that, within the manufacturing sector, there is a shift toward greater exports at the later stages of processing and away from those at the earlier stages. Under the high elasticity assumption exports to ROW fall - especially exports of primary metals. This also explains why total exports shift toward manufacturing under the high tariff scenario. Under the low elasticities assumption, the expansion of exports of manufactured goods is also in evident, but there is no evidence of a shift within manufacturing toward end stage processing.

On the import side expansion is also focussed on manufacturing - presumably because the trade barriers which will be removed under the agreement are greater in this sector. Imports from the United States increase due to the trade liberalization, and the rise in Canada's GNE. Under the low elasticities assumption, the increase in Canada's GNE is less than .5 percent but imports from the ROW are encouraged by the rise in Canada's terms of trade which makes imported goods less costly. Under the high elasticities assumption, Canada's terms of trade fall but, in this case, imports from the ROW are induced by an increase in GNE of over 4 percent.

The pattern of trade is insensitive to the assumption adopted concerning elasticities. The ratio of exports or imports to domestic production is similar under either assumption whether we look at the data in terms of the industrial or commodity classification. This is also true of net exports. From this we conclude that cost factors (economies of scale, tariffs, NTBs) and government procurement play a dominant role in determining the pattern of trade. The currency conversion factor works through the terms of trade to moderate the influence of elasticities. When elasticities are assumed to be high, Canada's terms of trade rise, moderating the increase in exports to the US and causing exports to the ROW to decline. Canada imports more from both the US and the ROW sources under the high elasticity assumption. Under the low elasticity assumption imports from the ROW are less than observed under the assumption that they are high.

If Canada fails to find increased markets in the US, the fall in the terms of trade will bring about a reduction in imports from the ROW. However, the more successful we are at finding markets in the US the more Canadian and US improvements in trade will have some spillover in benefits to the rest of the world through increased imports.

expert opinion would favour the high elasticities assumption and therefore this scenario represents a more probable outcome than the low elasticities assumption. Industries in which labour requirements expand under this assumption are more favoured than those which do not.

CONCLUSION

Under the bilateral agreement output should expand in nearly all industries. Even under the low elasticity assumption there are few exceptions. The changes in the levels of output can be explained in general terms by changes in the terms of trade, the level of national income and by the assumed level of export elasticities. Variations in detail can be explained in terms of the variation in NTBs, the tariff schedules, or changes in the bias in government procurement. Since the expansion is greatest in the manufacturing sector under both the low and high elasticity cases, and since economies of scale are assumed to be present only in manufacturing, we may conclude that cost changes are the dominant feature in accounting for the changes in output by industry. The agreement should not change the relative sizes of Canadian industries.

Labour requirements are more sensitive. Although total labour requirements increase and although output in nearly all industries increase, there are employment decreases in many manufacturing industries. The number actually showing decline will depend on Canada's export success in the US market.

CHAPTER IV

RATIONALE

The point was stressed in Chapters I and II that, when a policy that will change the entire tariff schedules of two trading partners is considered, it is necessary to go beyond a simplistic analysis which, in effect, considers each industry in isolation one at a time. Economy-wide factors have to be taken into account. However, once we have decided to broaden the sweep of our analysis, we face the difficult task of deciding what economic aspects should be included as endogenous variables to be determined in the model and which should be taken as given exogenous values. There is hardly any economic variable that is totally irrelevant - everything depends on everything else. One of the purposes of this chapter is to clarify what we have brought in and what we have left out and why.

In making our choices we were guided by the Real Theory of International Trade. This is the body of theory that economists have developed to explain how changes in prices and costs affect the nation's output and employment by industry and how they change the import and export pattern by nation. As in most general equilibrium applications, however, it is necessary to go beyond the Real Theory because of certain special considerations. This topic is the subject of the first half of this chapter. In the second half we provide a more precise verbal description, detail the sources of our data and explain how the model was solved. However, we leave the precise mathematical description for the next chapter.

TWO APPROACHES TO GENERAL EQUILIBRIUM MODELLING

In the past decade a growing number of applied general equilibrium models have been implemented and used for policy simulation. They fall into two classes, termed by Ginsburg and Waelbroeck (1981) the Computable General Equilibrium (CGE) approach and the Activity Analysis General Equilibrium (AGE) approach.

The CGE approach to general equilibrium modelling is well described by Shoven and Whalley (1984). In essence, the procedure is to derive a system of excess demand equations for commodities and factors of production based on an explicit set of production functions for firms and utility functions for consumers. Intermediate goods are incorporated through an input-output matrix. The model is calibrated to fit the data of a reference year. It is then solved for alternative specifications of tax or tariff parameters.

Examples of the CGE approach applied to Canadian data include Boadway and Treddenick (1978), Harris with Cox (1983), and Whalley (1986). Whalley's paper is actually a model of multilateral world trade involving eight regions (one of which is Canada) and six industries. Harris's model of the Canadian economy has been very influential in policy discussions. Particularly important was his treatment of economies of scale, which can be realized in his model if trade liberalization leads to longer production runs by representative firms in manufacturing industries.

Computable General Equilibrium models have been markedly successful in providing insight into the effects of tax and tariff changes on national economies. The CGE models mentioned above all assume a value added function exhibiting capital-labour substitution supplemented by intermediate factor demands derived from input-output matrices. Closed form expressions for excess demand and supply functions are derived from explicit utility and production functions.

In the AGE approach, production is represented by a convex production set defined by a number of production activity vectors. For example, one production activity might be the manufacture of newsprint using a specified bundle of commodities and primary factors as inputs. The data specifying these activities can be drawn directly fro input-output accounts or it can be derived from engineering information. The consumption opportunities for the economy are described by a convex consumption possibilities set determined by the production set and opportunities for trade in intermediate and final products. The economy is then presumed to operate so as to maximize a certain concave objective function defined over the consumption set. Consequently, the solution to an AGE model is obtained as the solution to a mathematical optimization problem rather than as the solution to a set of simultaneous excess demand equations.

Only one study relying entirely on the AGE method has been applied to Canada, which is the earlier study by one of us (Williams, 1978). That study applied the AGE method to Canadian data for 1961. Production activities were drawn from a squared version of the Canadian input-output tables and the economy was assumed to maximize the utility of a bundle of outputs consumed in fixed proportions, subject to distortions introduced by the tax and tariff system. The study indicated that bilateral free trade with the United States would lead to an increase of approximately 4 percent in the value of Canadian consumption.

This earlier study suffered from a number of limitations largely due to the computational technology of the time. Most notably the solution algorithm relied entirely on linear (as opposed to concave) programming. Since the objective function was linear, no substitution was allowed in consumption.

Moreover, there was a tendency for Canada to specialize completely in the production of some outputs while closing down production of the rest. Other weaknesses were a lack of attention to capital-labour substitution, the assumption of exogenous foreign prices, and a failure to consider the effects of economies of scale.

Ginsburg and Waelbroek (1981) showed that the problems of overspecialization can be avoided by using non-linear objective functions and constraints while retaining the use of activity analysis to formulate an AGE model. While Ginsburg and Waelbroeck solved their model using linear approximations to their non-linear objective function and constraints, recent developments in computation allow large scale non-linear programming problems to be solved directly with packaged software (Murtagh and Saunders). For this reason and for the reasons noted below, it was decided to adopt the AGE approach.

ADVANTAGES OF THE AGE APPROACH

It is generally understood that any competitive equilibrium is equivalent to the solution of an appropriately constructed optimization problem.[1] AGE models are constructed so as to yield solutions which can be interpreted as competitive equilibria. Accordingly, the AGE approach to general equilibrium modelling can be interpreted as a method of solving competitive general equilibrium models without recourse to closed form supply and demand functions. In fact, the solution to an AGE model is consistent with any market structure with a zero profit long-run equilibrium condition. Consequently, the assumption of perfect competition is not required for the validity of an AGE model.

The zero profits assumption is consistent with a wide variety of market forms including perfect competition, monopolistic competition and most varieties of oligopoly. This assumed variety of behaviour more closely matches the variety of activities actually present in the input-output source data and the industry-commodity format. Industries in the input-output accounts represent collections of heterogeneous establishments classified together because of some common characteristic such as the use of a common material, production of the same type of output or simply because they all employ the same production methods. Generally, the establishments in a particular industry produce more than one kind of output and their products are similar but not identical. A firm may have establishments in more than one industry. Accordingly, it is unwise to assume that competitive conditions are the same for all firms grouped in a common industrial classification.

As in most general equilibrium models, we depart from the real theory assumption that commodities are internationally homogeneous. Commodities from different international sources are treated as imperfect substitutes. However, we differ from other general equilibrium studies in that we maintain the distinction in the Canadian Input-Output Table between industries and commodities.

Statistics are collected by Statistics Canada in accordance with one of several classifications. There are special commodity classifications for imports, exports, tariffs and an industrial classification for data relating to manufacturing (such as employment). Data relating to manufacturing are typically collected in accordance with the Standard Industrial Classification. Imports, exports and the Canadian tariff are concorded in a single commodity classification called the Standard International Trade Classification. Employment and other industry data are concorded in the Standard Industrial Classification. In the input-output accounts which underlie our study, commodities are aggregated into 94 commodity classifications while industry data are aggregated into only 43 industries.

It is common practice in applied general equilibrium models to work only with the industry classification, treating all production in each industry as a single commodity with a single tariff applied. In this study we describe consumer behaviour in terms of input-output commodity classification and production in terms of the input-output industrial classification rather than combining these into one aggregation.

This distinction between commodities and industries is found in other general equilibrium models and is also one of the novel features of our approach. Because the industry-commodity distinction is maintained in the model specification, we are able to work with a larger number of commodity classes, reducing error through aggregation. It allows us to distinguish between the effects of commodity-based taxes and tariffs and the effects of industry-based taxes and subsidies. Furthermore, the tariff rates are calculated for an aggregate of homogeneous commodities rather than for an industrial aggregate which is composed of a grouping of heterogeneous commodities. More importantly, the distinction allows us to apply a different tariff rate according to use.

The Canadian tariff schedule is permeated with clauses that apply a high tariff rate on goods when purchased by the general public but a reduced rate (often equal to zero) or duty remission on goods imported for use in production. In highly aggregated models both types of imports are combined in a single aggregated class and an average tariff is then computed. Usually, the tariff rate that consumers actually manufacturers is below the average level. In a study intended to trace out the effect of tariffs on relative costs, it is obviously of great importance to apply a different rate of tariff on goods to be used in further processing when this rate differs from the one applied to goods purchased by consumers.

We have designed the model to accommodate differential tariffs on intermediate and final goods. We do this by distinguishing between commodities imported for final consumption and those imported as inputs into further production. Commodities imported for final consumption are treated as imperfect substitutes for the corresponding domestic product and for each other. Commodities imported for intermediate use from each region are assumed to constitute fixed proportions of output.

AGE models offer a number of practical advantages. As noted, they do not require closed form supply and demand functions; they can be specified so as not to depart from observed production technology; they can easily accept externally generated information concerning changes in technology; quantitative constraints on production and trade can be incorporated naturally and easily; finally, substitution between labour and capital and among products can be introduced to any degree desired by increasing the number of activities defining the production or consumption sets.

MAJOR CONSIDERATIONS IN DESIGNING THE MODEL

A major concern in designing the model was to maintain maximum consistency with the Real Theory of International Trade (as opposed to the Monetary Theory). Other important considerations were to treat imports for intermediate use separately from imports for final consumption, to make full use of commodity detail available in the input-output accounts, to account correctly for "margins", and to incorporate the effects of economies of scale induced by exposure to international competition. Each of these points is expanded below.

To understand the approach taken in this study, the reader must distinguish between the Real Theory and the Monetary Theory of International Trade. The Monetary Theory is concerned with short-run problems of balance of payments disequilibrium and adjustment. In the Monetary Theory of International Trade, the general price level and the exchange rate have a significant impact on short-run changes in aggregate employment and output. According to the same theory, however, there is neutrality of money in the long-run. Because of purchasing power parity, a given percentage change in the supply of money will, in the long-run, change the price level and the exchange rate by the same percentage leaving the interest rate unchanged. Accordingly, monetary variables do not play a key role in determining the long-run adjustment to changes in trade policy.

One may also distinguish between the Monetary Theory and the Real Theory of International Trade in terms of the impact on relative output and employment across industries. The changes in relative output and employment by industry are the main subjects of the Real Theory of International Trade. The long-run equilibrium of relative output and employment by industry is determined by relative prices. General equilibrium models based on the Real Theory of International Trade do not attempt to describe the short-run adjustment of the economy, or the variation in aggregate output, or employment over the business cycle: in such models we do not attempt to determine the price level or the rate of interest or the exchange rate in the usual sense of this variable.

The exchange rate which we calculate is a measure of the value of one unit of foreign exchange to the national economy but is not a price which would clear financial markets. To avoid confusion, we have referred to the rate determined in our model as the currency conversion factor, reserving the term "exchange rate" for the price which would bring about balance of payment equilibrium in a model in which the monetary sector has been fully specified.

Similar comments apply with regard to investment. The level of investment is a key variable in the study of the business cycle. When monetary authorities increase the money supply and lower interest rates, they hope to encourage businessmen to advance their plans for capital expansion and thus stimulate output and employment in the current period. The national supply of capital in the long-run depends on national productivity and the willingness of individuals to invest and save. The individual's savings decision is a long-term consideration in which age is an important variable. Generally, individuals are net borrowers at young ages and then accumulate wealth for retirement as they get older. To incorporate aspects of capital formation one would need a dynamic model which would involve several time periods - an exercise which would considerably complicate our efforts and increase the costs of this project well beyond a support level that could be justified.

It is our assumption that the tariff will have little influence on the individual's lifetime planning, and we have therefore taken the rate of domestic savings and investment as exogenous, setting it equal to its level in the 1981 reference period rate. This is consistent with the Real Theory of International Trade and with current practice in general equilibrium modelling.

The input-output data which form the basis of this study value all transactions at producers' prices. Consumers pay these prices plus margins for transportation, storage, wholesaling and retailing, as well as indirect taxes and tariffs. Margins can increase the consumer price of a commodity by a factor of two or three. In our study we have been careful to account for these factors which cause consumers' prices to deviate from producers' prices.

The Canadian literature since the Second World War has focussed on the role of economies of scale as the principle source of gains from trade. This literature begins with the observation that Canadian plants are smaller in scale and produce a wider range of outputs than their U. S. counterparts (Baldwin and Gorecki, 1985). Stykolt and Eastman (1960) and English (1964) ascribed this difference to imperfect competition in the small, protected Canadian market. Firms were assumed to collude sufficiently to price up to the domestic tariff but not sufficiently to prevent the entry of new capacity. Consequently a zero profit equilibrium would be established in which all firms would operate at less than minimum efficient scale. This effect would be particularly important when output at minimum efficient scale was a large fraction of the domestic market. Muller (1982) reviews several empirical studies which confirm that scale efficiency is positively related to the size of the market.

Recently Harris (1984) and Harris and Cox (1983) incorporated a version of this theory in a computable general equilibrium model of the Canadian economy. In the Harris model, prices are set either by a mark-up over variable costs or by reference to the landed price of imports. A zero profit condition ensures that average cost will equal price in the long-run. Tariff reductions can lead to increased realization of economies of scale by reducing the extent of excess capacity held by the representative firm. Similar arguments suggest that tariff reductions would reduce the diversity of product lines produced in Canadian plants.

It is important to note that the economies of scale being discussed depend on the output of the individual plant, not on the output of the industry as a whole. There is no necessary correlation between changes in average plant size and changes in total industry output. When a protected industry is exposed to freer trade, plants with high average costs due to diversification or suboptimal scale will tend to earn lower profits. In order for them to remain viable, they must reduce average costs by specializing or by increasing their total output. Thus freer trade will tend to reduce diversity and increase the average size of plant regardless of whether total industry output expands or contracts.

If plants reduce average costs by achieving economies of scale, average costs at the industry level will also decline.

We assume that most of the cost saving arises from reduced labour and capital requirements per unit of output. Consequently, we model the changes in the economies of scale achieved by individual firms by changing the input coefficients observed at the industry level. We do not attempt to model explicitly the change in output of the average firm and we do not need to make an explicit assumption about the nature of competition in the various industries. Our procedure is consistent with perfect competition, monopolistic competition, or oligopoly with ineffectively impeded entry.

Specifically, we assume that free trade will eliminate any cost penalty associated with suboptimal plant scale, using estimates of cost penalties in Canadian Manufacturing prepared by Lester and Robidoux (1986). The cost penalty is the difference between observed average cost in the 4-digit industry and the minimum achievable average cost, expressed as a fraction of observed average cost. We then compute the new capital and labour coefficients which would yield the estimated reduction. For example, if labour and capital account for 50 per cent of unit costs we must reduce the labour and capital coefficients by 10 percent to achieve a reduction in average cost of 5 percent. To compute the gains from the realization of economies of scale we solve our model using the adjusted capital and labour coefficients.

Earlier applications of AGE models to the simulations of national economies were based on linear programming. These efforts were met with severe criticism.[2] First, it was easy to confuse the objective of general equilibrium modelling with that of optimal planning. Second, it was necessary to impose _ad hoc_ constraints to avoid excessive specialization caused by the linearity of the objective function. Third, the _ad hoc_ constraints frequently led to dual solutions which had no reasonable economic interpretation.

We believe that our present work avoids these objections. First, we stress that we use mathematical programming to solve a general equilibrium model, not to maximize the utility of consumption or any other planning criterion.[3] Second, we avoid excessive specialization in consumption by introducing a non-linear, concave utility function and by adopting the Armington assumption that commodities imported for final consumption are imperfect substitutes for each other and for the domestic product. We avoid specialization in exports by introducing an explicit trade welfare function for the Rest of the World. This function implies a finite elasticity of demand for Canadian exports. Finally, our model is specified in such a way that the Kuhn-Tucker conditions for a maximum in the associated programming problem replicate the equilibrium conditions for a competitive economy.

GENERAL DESCRIPTION OF THE MODEL

Briefly, the model distinguishes seven kinds of economic activity: final consumption of commodities (domestically produced or imported), export of commodities, provision of intermediate commodities, production of commodities, supply of labour, supply of capital and collection of indirect taxes. An equilibrium is defined as a set of activity levels and corresponding prices which satisfy the following conditions:

i. Market Clearing: The supply of each commodity and factor of production equals the demand except for the possibility (formally present but not of practical interest) that supply may exceed demand at a price of zero.

ii. External Balance: The foreign exchange earned by exports is sufficient to pay for the commodities imported and to compensate foreigners for our net use of their capital.

iii. Zero Profits: No activity is carried on unless the revenue from the activity covers cost and no activity exhibits pure profits, i.e. revenues which exceed costs.

Activities

The role of the household in the model is represented by consumption activities. Commodities imported from abroad are assumed to be imperfect substitutes for those produced in Canada. The consumer satisfaction derived from this consumption is represented by CES sub-utility functions which are nested in a Cobb-Douglas overall utility function. In the present model there are 94 commodities[4] and five world regions: Canada, the United States, Japan, the European Economic Community and the Rest of the World.

Some of that which is imported is classified as intermediate goods. These may arrive from any one of the four regions. To represent this activity, we introduce the notion of a composite intermediate commodity which is made up by combining domestically produced and imported amounts of each commodity in fixed proportions. In the absence of discrimination, the tariff applied to a particular imported commodity depends only on the relative domestic content.

Foreign exchange is earned through activities representing exports. Of the 94 domestically produced commodities there are 92 which might be exported to any one of the four national regions outside Canada.

Production activities are summarized by vectors whose elements represent the production. In the Canadian input-output data there are 43 industries, each of which produces several commodities. For example, the paper industry produces the commodities newsprint and other paper stock, pulp, and other paper products as well as a number of miscellaneous outputs. We introduce an activity for the production of each major commodity. This amounts to assuming perfect substitution between the major outputs of each industry.

Industries also require capital and labour whose supply is endogenous. Each industry is assumed to use capital and labour in fixed proportions. This assumption is adopted partly for practical reasons and partly for conceptual ones. As a practical matter, there are no estimates of the substitution elasticities between capital and labour for the Canadian Industrial Classification, and the large number of such industries rules out any prospect of making such estimates.

Conceptually, substitution is an activity which takes place at the level of the firm. Strictly speaking, estimates of the substitution elasticity between capital and labour should be based on firm-level data. Unfortunately, the mathematical functions assumed to hold at the level of the individual firm change their form in unknown ways under aggregation.

Even if the mathematical forms were unchanging under aggregation we would still have an estimation problem of a different kind. Substitution elasticities at the level of the industry must be derived from the firm level elasticities and therefore depend on the relative importance of each firm in the industry's total. When the price of labour rises relative to rents on capital, there is substitution of capital for labour at the firm level but, simultaneously, firms in that industry which are labour intensive reduce output relative to capital intensive ones. Industry level substitution therefore depends very much on the relative proportions of firms with high and low capital-labour ratios in the output of the industry concerned and these proportions change when the wage-rent ratio changes.

We stress that lack of capital-labour substitution is not an inherent feature of the AGE approach. It can be represented to any desired degree by introducing alternative production activities with differing capital-labour ratios. These additional activities can be derived from historical data or from engineering estimates. We expect to introduce substitution based on observed patterns of capital-labour use in the near future. In the present model an increase in the rent-wage ratio will increase the supply of capital and reduce the supply of labour. At the same time, it will lead to an increase in the output of capital intensive industries and to contraction in the labour intensive ones.

The supply of labour is represented with an exponential disutility of labour function. The supply of labour depends on the real wage. It is assumed that overall utility is separable in labour and consumption. As noted in Chapter I, the supply of capital increases through capital inflows which occur when the productivity of a unit of foreign exchange in Canada increases. The model represents the long-run equilibrium adjustment of the economy and, therefore, does not trace out the steps leading to a higher level of capital stock. The growth in capital stock leads to higher real income in Canada but greater dividends must be paid to foreigners.

The final activity in the model is the collection of indirect taxes and tariffs. Indirect taxes and tariffs drive wedges between producers' and consumers' prices and consequently distort consumption and production decisions. Taxes enter the programming formulation in such a way as to guarantee that these distortions are treated appropriately.

Market Clearing Conditions

In a market economy, prices are set in such a way that the supply and demand for goods and factors are in equilibrium. The demand for domestically produced commodities must equal the supply (except that formally we allow for the possibility that, at a zero price, supply may exceed demand). Domestically produced commodities are demanded for final consumption, for export and for intermediate use. Some intermediate commodities are also consumed as "margins" in the consumption of the various consumer commodities. For example, the consumption of motor vehicles will entail a demand for retail, wholesale and transportation margins.

Similarly, the wage must be such that the supply of labour equals the demand for labour in production of commodities plus that amount demanded directly by households, and the supply of capital must equal demand. Related to the market clearing conditions is an accounting constraint that requires the total indirect tax collections to equal the total taxes and tariffs collected on exports, imports, consumption, and production.

Finally, there is a constraint which relates to the market for foreign exchange. In the reference year (1981), Canada experienced a trade surplus. This represented a transfer of real goods and services from Canada to the Rest of the World. We require that the same real transfer of resources be feasible in any new equilibrium.

Costs and Prices

Our model is intended to represent the long-run behaviour of firms. No firm can operate in the long-run if costs exceed revenue and, because we assume freedom of entry, in the long-run no firm can earn monopolistic profits or rents -- average cost must equal price. We refer to this long-run level of costs as the producer's price. In the long-run, firms that cannot cover their producer's costs close down. Taxes and subsidies enter the model as part of average costs and are therefore part of the producer's price. Taxes raise the producer's price while subsidies lower it.

The level of consumption of a particular commodity depends on the price that consumers are willing to pay. This is known as the demand price. The market price is the price the consumer must pay. It is equal to the producer's price plus commodity taxes, and margins paid for retailing, wholesaling and transportation. When the market price exceeds the demand price, consumption is reduced and the market price falls. In an extreme case (as with some potential imports) we reach an equilibrium in which none of a particular commodity is consumed -- the market price exceeds the demand price with none being consumed in equilibrium.

For all commodities that are consumed, the demand price must equal the market price. If this were not the case, consumers would increase their expenditures, purchasing more of those commodities whose demand prices exceed the market price and less of those commodities whose demand prices fall short of the market price. Since commodity taxes are added on to the producer's price, they increase the market price, thus reducing consumption.

A similar condition holds for the production of the composite intermediate commodity. Arbitrage requires that the price of the composite commodity must not exceed the sum of the costs of the domestic and imported components, while long-run equilibrium requires that no production of the composite commodity will occur unless its price at least covers the cost. For exports, the arbitrage condition is that the domestic value of foreign exchange earned from exporting cannot exceed the domestic cost of the export commodity plus any export tax. The zero profit condition requires that no exports be undertaken unless price covers cost including the export tax.

Labour is treated as a single homogenous factor of production. In this case, arbitrage requires that the wage not exceed the disutility of labour. In a long-run equilibrium the wage must be at least equal to labour's willingness to work as measured by the disutility of labour.

In principle, export and import prices should be proportional to the prices at which foreigners are willing to exchange. We assume that the foreign exchange prices of Canadian imports are constants but export prices are determined by the foreigner's willingness to pay. The willingness to pay functions are derived from constant elasticity of demand functions. It is assumed that the foreign trade welfare function is additively separable in Canadian exports.

How the Model is Solved

As we noted earlier in this chapter, there is a concave programming problem equivalent to most applied general equilibrium models. This is true of the problem stated above. We therefore solve for a set of prices and activities which satisfy the above equilibrium conditions by solving the programming problem which yields these conditions as first order conditions. The appropriate maximand turns out to be the utility of consumption less the disutility of labour less indirect taxes and tariffs collected less the amount of foreign interest and dividends payable.

It seems straightforward to show that the Kuhn-Tucker conditions for this problem replicate all the equilibrium conditions listed above, including the zero profit conditions -- provided we interpret the dual variables of the Kuhn-Tucker problem as equivalent to the price variables. We found in practice, however, that the presence of the non-linear constraint in this problem format causes a number of numerical problems and we therefore proceeded in an indirect manner. Assuming exports are fixed, we first found the equilibrium solution by solving a maximization problem for which the first order conditions are the same as the equilibrium conditions just described. We then used the dual prices and exchange rate from this solution in the export demand equations to calculate the desired level of exports. The level of exports so calculated was then taken as exogenous for the purpose of again solving the programming problem. This iterative process was continued until the actual level of exports desired corresponded to the levels assumed in the maximization problem. Properties of the solution so obtained then satisfied the conditions described verbally above and mathematically in the appendix.

Data Sources

Most of the data for this study were provided by the Economic Council of Canada. The elasticities of substitution used in the welfare function were taken from Shiells, Stern and Deardorff, (1988) or, when not available from this source, from elasticities of demand supplied by the Council. (A schedule of elasticities used may be obtain by writing to the authors.) The mathematical equations representing the willingness to pay for exports are derived from constant elasticities of demand for export functions. The elasticities were obtained from the Economic Council of Canada. The Council was also our source for the level of Canadian duties assumed to hold on final demand goods entering Canada. However, the duties used for imports of intermediate goods were derived by us from Trade of Canada data purchased from Statistics Canada. Estimates of non-tariff barriers in Canada and the United States and of the biases in government purchasing practices were also obtained from the Council. Estimates of the cost disadvanage by industry were obtained from Robidoux and Lester (1988). The required input-output data came from the Input-Output section of Statistics Canada.

FOOTNOTES

[1] See Waelbroeck (1987) and Negishi (1960).

[2] We rely here on Waelbroeck's concise discussion of these criticisms, especially Taylor's (1975).

[3] This is why the objective function in our programming problem takes on a form which seems strange if the reader is thinking of optimal planning rather than general equilibrium modelling.

[4] Plus the direct labour component of final demand.

Chapter V

Technical Description of the Model

This chapter presents details of the model used to simulate the trade liberalization scenarios that were discussed in earlier chapters. We consider first the various economic activites included in the model, secondly the equilibrium conditions that were imposed, thirdly the solution algorithm used to calculate equilibrium values and finally the modifications made to the model when simulating various free trade scenarios. A complete listing of the model and the symbols used in it appears in Appendix A.

Briefly, the model distinguishes seven kinds of economic activity: final consumption of commodities (domestically produced or imported), exports of commodities, provision of intermediate commodities, production of commodities, supply of labour, imports of capital, and collection of indirect taxes. An equilibrium is defined as a set of activity levels and corresponding prices which satisfy the following conditions:

Market Clearing — the supply of each commodity and factor of production equals or exceeds the demand.

External Balance — the foreign exchange earned by exports is sufficient to pay for the commodities imported and to compensate foreigners both for the net use of their capital and any net increase in Canadian ownership of foreign assets.

Zero Profits — no activity is carried on unless the revenue from the activity covers the cost of the activity and no activity exhibits pure profits, i.e. revenues which exceed costs.

These equilibrium conditions can also be interpreted as the first order (Kuhn-Tucker) conditions for a certain maximization problem. We solve for the equilibrium solution by first finding and then solving a maximization problem which has first order conditions equivalent to the equilibrium conditions just described. We now describe the activity variables, the equilibrium conditions and the solution algorithm in greater detail.

4.1 Activities

Consumption of commodity i from region h is denoted by c_{ih}. Domestically produced commodities (c_{i0}) are assumed to be imperfect substitutes for commodities imported for final demand. Consumption from the various regions is aggregated by CES sub-utility functions which are nested in a Cobb-Douglas overall utility function. In the present model there are 94 goods and services. The direct labour component of final demand is treated as a ninety-fifth commodity. There are five world regions: Canada, the United States, Japan, the EEC and the Rest of the World.

Exports of commodity i to region h are denoted by e_{ih}. There are 92 domestically produced commodities which might be exported. The number actually exported is determined by the data for the reference year. The activities of providing intermediate goods are denoted q_{ir}, which represent the provision of one unit of intermediate commodity i under trade pattern r. This specification requires some elaboration.

Since intermediate goods from alternative sources are assumed to be perfect substitutes, we avoid excessive specialization by restricting each region's market share to historically observed levels. To implement this idea, we introduce the notion of a composite intermediate commodity i which is made up by combining domestically produced and imported commodity i in fixed proportions called trade patterns. It is useful to picture this composite commodity being produced by agents who combine imports (of a particular intermediate good) from various foreign sources with domestic production into a single composite commodity to be sold as an intermediate good in production.

In the present model there is one trade pattern for each commodity, namely the market share of each region in the provision of that commodity for intermediate use. These trade patterns can be supplemented by exogenously determined patterns or by patterns observed in other years. Future versions of the model will include trade patterns based on historical trade data.

The national content of the intermediate good depends on the tariffs charged and the non-tariff barriers that are applied. In the absence of discrimination, the tariff applied to a particular composite commodity would depend only on the share of imports in that commodity. With discrimination (in the form of either tariffs or non-tariff barriers) the duty also depends on the national composition of imported intermediate goods.

Production activities are denoted by x_j, each representing the production of a certain bundle of commodities by industry j. In the Canadian input-output data there are 43 industries, each of which produces several commodities. For example, the paper industry produces the commodities newsprint and other paper stock, pulp, and other paper products as well as a number of miscellaneous outputs. We introduce an activity for the production of each major commodity. This amounts to assuming perfect substitution between the major outputs of each industry.

The final activity in the model is the collection of indirect taxes and tariffs, z. Indirect taxes and tariffs drive wedges between producers' and consumers' prices and consequently distort consumption and production decisions. The variable z enters the programming formulation in such a way as to guarantee that these distortions are treated appropriately.

4.2 Market Clearing Conditions

4.2.1 Domestic Goods

There are three sets of market clearing conditions. First the demand for domestically produced commodities cannot exceed the supply. Domestically produced commodities are demanded for final consumption, for export and for intermediate use. Some intermediate commodities are also consumed as margins in the consumption of the various commodities. For example, the consumption of motor vehicles will entail a demand for retail, wholesale and transportation margins. These is also an autonomous demand arising from capital investment, inventory change and government consumption.

Let m^{g}_{ki} be the amount of commodity i which is required as a margin on the consumption of one unit of commodity j. Then $\sum_{h \in H} \sum_{k \in I} m^{g}_{ki} c_{kh}$ is the total demand for commodity i arising from consumption margins. Let θ_{ihr} be the share of region h in the production of the composite commodity i under trade pattern r Then $\sum_{r \in R} \theta_{i0r} q_{ir}$ is the intermediate demand for domestically produced commodity i. Let a_{i0} be the autonomous demand for commodity i. Finally, let ω_{ij} be the output of commodity i per unit of activity of industry j.

$$\sum_{h=1}^{N^H} e_{ih} + \sum_{h \in H} \sum_{k \in I} (1 + m^{g}_{ki}) c_{kh} + \sum_{r \in R} \theta_{ihr} q_{ir} + a_{i0} \leq \sum_{j \in J} \omega_{ij} x_j \; \forall i \in I \quad (4.1)$$

4.2.2 Intermediate Goods

The market clearing conditions for intermediate goods are simpler. They merely require that the total demand for the composite intermediate good cannot exceed the supply. Let α_{ij} denote the input of commodity i required per unit output of industry j. Then $\sum_{j \in J} \alpha_{ij} x_j$ denotes the total demand for commodity i in intermediate use. We require

$$\sum_{j \in J} \alpha_{ij} x_j \leq \sum_{r \in R} q_{ir} \; \forall i \in I \quad (4.2)$$

4.2.3 Labour

The market clearing condition for labour is that the demand for labour in production, plus the labour component of final demand, not exceed the supply of labour. Let β_j be the unit requirement for labour in industry j. Then $\sum_{j \in J} \beta_j x_j$ is the total demand for labour in intermediate use. Let β^{f}_{ih} be a dummy variable with value equal to unity when i denotes the direct consumption of labour as part of final demand. Then the labour market clearing conditions is simply

$$\sum_{j \in J} \beta_j x_j + \sum_{i \in I} \sum_{h \in H} \beta^{f}_{ih} c_{i0} + a^{\beta} \leq n \quad (4.3)$$

4.2.4 Capital

The market clearing condition for capital requires that the demand for capital in intermediate use does not exceed the exgoneously given supply of domestic capital plus the supply of imported capital, k^m. Writing b^γ for the supply of domestic capital and γ_j for unit capital requirement in industry j we have

$$\sum_{j\in J} \gamma_j x_j \leq b^\gamma + k^m \tag{4.4}$$

4.2.5 Indirect Taxes

Related to the market clearing conditions is an accounting constraint that requires the total indirect tax collections (z) equal the total taxes and tariffs collected on exports,imports, consumption, and production. Let t^e_{ih} represent export taxes, t^c_{ih} taxes and tariffs on consumption, t^{id}_{ihr} the tariffs on the imported portion of intermediate consumption and t^x_j indirect taxes on production. Let t^{ix}_{ir}be the non-tariff indirect tax on intermediate use of commodity i under trade pattern r. Then the total indirect tax and tariffs paid per unit of intermediate commodity i is

$$t^q_{ir} = \sum_{h=1}^{N^H} \theta_{ihr} t^{id}_{ihr} + t^{ix}_{ir}$$

and the tax constraint requires that

$$\sum_{i\in I}\sum_{h\in H} t^e_{ih} e_{ih} + \sum_{i\in I}\sum_{h\in H} t^c_{ih} c_{ih} + \sum_{j\in J} t^x_j x_j + \sum_{i\in I}\sum_{r\in R} t^q_{ir} q_{ir} \leq 0 \tag{4.5}$$

4.2.6 External Balance

Another constraint relates to the market for foreign exchange. In the reference year Canada experienced a trade surplus. This represented a transfer of real goods and services from Canada to the rest of the world partly in payment for the services of foreign-owned capital used in Canada and partly in return for a net increase in assets held abroad. We require that the same real transfer of resources be feasible in any new equilibrium. That is, we require

$$\sum_{i\in I}\sum_{h=1}^{N^H} p^m_{ih}\theta_{ihr}q_{ir} + p^{km} - \sum_{i\in I}\sum_{h=1}^{N^H} p^e_{ih}e_{ih} + \sum_{i\in I}\sum_{h=1}^{N^H} p^m_{ih}a_{ih} \leq b^{tr} \qquad (4.6)$$

This constraint is non-linear because the prices Canada faces for its imports and exports are affected by the quantity of goods and services it trades on international markets. In general, the import and export prices should be proportional to the gradient of the foreign trade welfare function. For our model we assume that import prices are constant and export prices are given by

$$p^e_{ih} = p^{f0}_{ih}(e_{ih}/e^0_{ih} - k^e_{ih})^{1/\eta^e_{ih}} - t^f_{ih} \qquad (4.7)$$

This specification implies that the foreign trade welfare function is additively separable in Canadian exports and that the income elasticity of demand for Canadian imports is zero.

4.3 Zero Profit Conditions

Our model is intended to represent the long-run behavior of firms. No firm can operate in the long-run if costs exceed revenue and, because we assume freedom of entry, in the long run no firm can earn monopolistic profits or rents — average cost must equal price. We refer to this long-run level of costs as the producer's price. In the long-run, firms that cannot cover their producer's costs close down. Taxes and subsidies enter the model as part of average costs and are therefore part of the producer's price. Taxes raise the producer's price while subsidies lower it. Since our model distinguishes between domestically produced commodities and composite intermediate goods, each commodity has two prices. Denote by p^ω_i the price of commodity i produced by Canadian firms. Let p^a_i denote the price of the composite intermediate good i. The zero profit conditions for production require that

$$\sum_{i\in I} p^\omega_i \omega_{ij} - \sum_{i\in I} p^a_i \alpha_{ij} - p^\beta \beta_j \;\leq\; 0$$

$$x_j\left(\sum_{i\in I} p_i^\omega \omega_{ij} - \sum_{i\in I} p_i^\alpha \alpha_{ij} - p^\beta \beta_j\right) = 0 \qquad \forall j \in J \tag{4.8}$$

Analogous rules hold regarding consumption activities. The level of consumption of a particular commodity depends on the price that consumers are willing to pay. This is known as the demand price. The market price is the price the consumer must pay. It is equal to the producer's price plus commodity taxes, and margins paid for retailing, wholesaling and transportation. When the market price exceeds the demand price, consumption is reduced and the market price falls. In an extreme case (as with some potential imports) we reach an equilibrium in which none of a particular commodity is consumed — the market price exceeds the demand price with none being consumed in equilibrium. For all commodities that are consumed, the demand price must equal the market price. If this were not the case, consumers would increase their expenditures, purchasing more of those commodities whose demand prices exceed the market price and less of those commodities whose demand prices fall short of the market price. Since commodity taxes are added on to the producer's price, they increase the market price, thus reducing both production and consumption. We can express these conditions formally as follows. For domestically produced commodities,

$$\begin{aligned} p_i^\omega + \sum_{k\in I} p_k^\omega m_{ki}^g + p^\beta \beta_{ih}^f - \partial U/\partial c_{ih} &\geq 0 \\ c_{ih}\left(p_i^\omega + \sum_{k\in I} p_k^\omega m_{ki}^g + p^\beta \beta_{ih}^f - \partial U/\partial c_{ih}\right) &= 0 \\ &\forall i \in I, h = 0 \end{aligned} \tag{4.9}$$

For commodities imported for final consumption, arbitrage prevents the foreign exchange earnings expressed in domestic prices from exceeding the domestic price of the commodity plus any export tax, while long-run equilibrium requires that no exports will be undertaken unless the foreign exchange earnings cover the cost to the exporter. Let p^{tr} denote the domestic price of foreign exchange. Let p_{ih}^m denote the foreign exchange cost of imports from region h. Then the condition for imported final commodities is

$$
\begin{aligned}
p^{tr}p^{m}_{ih} + \sum_{k\in I} p^{\omega}_{k} m^{g}_{ki} + p^{\beta}\beta^{f}_{ih} - \partial U/\partial c_{ih} &\geq 0 \\
c_{ih}(p^{\omega}_{i} + \sum_{k\in I} m^{g}_{ki} + p^{\beta}\beta^{f}_{ih} - \partial U/\partial c_{ih}) &= 0 \qquad (4.10) \\
\forall i \in I, h \in \{1,\ldots,N^{H}\}
\end{aligned}
$$

A similar condition holds for the production of the composite intermediate good. Arbitrage requires that the price of the composite good not exceed the sum of the costs of the domestic and imported components, while long-run equilibrium requires that no production of the composite good will occur unless its price at least covers the cost. Consequently we have

$$
\begin{aligned}
p^{tr}\sum_{h=1}^{N^{H}} p^{m}_{ih}\theta_{ihr} + p^{\omega}_{i}\theta_{i0r} + t^{q}_{ir} - p^{\alpha}_{i} &\geq 0 \\
q_{ir}(p^{tr}\sum_{h=1}^{N^{H}} p^{m}_{ih}\theta_{ihr} + p^{\omega}_{i}\theta_{i0r} + t^{q}_{ir} - p^{\alpha}_{i}) &= 0 \qquad (4.11) \\
\forall i \in I,\ r \in R
\end{aligned}
$$

For exports, the arbitrage condition is that the domestic value of foreign exchange earned from exporting cannot exceed the domestic cost of the export good plus any export tax. The zero profit condition requires that no exports be undertaken unless price covers cost including the export tax.

$$
\begin{aligned}
p^{\omega}_{i} + t^{e}_{ih} - p^{tr}p^{e}_{ih} &\geq 0 \\
e_{ih}(p^{\omega}_{i} + t^{e}_{ih} - p^{tr}p^{e}_{ih}) &= 0 \qquad (4.12) \\
\forall i \in I, h \in \{1,\ldots,N^{H}\}
\end{aligned}
$$

Labour is treated as a single homogenous factor of production. In this case, arbitrage requires that the wage not exceed the disutility of labour. A long-run equilibrium condition is that the wage be at least equal to labour's willingness to work as measured by the disutility of labour. Let be the wage rate and let $\partial D/\partial n$be the partial derivative of the disutility of labour function with respect to labour. Then we require

$$\begin{aligned} p^{\beta} - \partial D/\partial n &\geq 0 \\ n(p^{\beta} - \partial D/\partial n) &= 0 \end{aligned} \tag{4.13}$$

Finally, capital imports will not be undertaken unless the domestic rental price of capital, p^{γ}, is at least equal to the rental price of foreign capital expressed in domestic currency. Since the foreign price of imported capital is normalized to unity, the domestic price is simply p^{tr}. Thus we have

$$\begin{aligned} p^{tr}p^{km} - p^{\gamma} &\geq 0 \\ k^{m}(p^{tr}p^{km} - p^{\gamma}) &= 0 \end{aligned} \tag{4.14}$$

The zero profit condition requires that capital imports occur only when the two prices are equal.

4.4 The Programming Problem

We solve for a set of prices and activities which satisfy the above equilibrium conditions by solving the programming problem which yields these conditions as first order conditions. The appropriate maximand turns out to be the utility of consumption less the disutility of labour less indirect taxes and tariffs collected. Formally the problem may be written as follows. Let $\mathbf{z}$ be the vector of all activity variables. Then a solution to the model is a vector $\mathbf{z}^* \geq 0$ such that when export prices are held fixed at

$$p^{e}_{ih} = p^{e}_{ih}(e^{*}_{ih})$$

$\mathbf{z}^*$ solves the problem

$$\max_{\mathbf{z}} \, (U - D - z) \text{ subject to equations (4.1) to (4.6)} \tag{4.15}$$

It is straight-forward to show that the Kuhn-Tucker conditions for this problem replicate all the equilibrium conditions listed above, including the zero profit conditions (4.8) to (4.13), provided we interpret the dual variables of the Kuhn-Tucker problem as equivalent to the price variables p^{ω}_{i}, p^{α}_{i}, and p^{tr} used in the previous discussion.

The utility function U is a Cobb-Douglas aggregate of CES subutility functions s_i^u.

$$U = \prod_{i \in I} (s_i^u)^{\epsilon_i} \tag{4.16}$$

where

$$s_i^u = \sum_{h \in H} (d_{ih} c_{ih}{}^{-\rho_i})^{-1/\rho_i} \tag{4.17}$$

The elasticities of substitution in the CES sub-utility functions are derived from estimates of import elasticities provided by the Economic Council of Canada. The disutility of labour, D, is an exponential function of labour supply calibrated to yield a labour supply elasticity of 0.30.

$$D = k^n n^{(\eta^e + 1)/\eta^e} \tag{4.18}$$

One difficulty arises because the export and import prices in the external balance equation (4.6) are not constant, but rather depend on the dual prices computed for domestic commodities and on the level of exports. Such a dependence cannot be handled directly by the solution program we employed. To deal with this problem, we followed the following iterative procedure. First we solved the the programming problem (4.15) on the assumption that exports were fixed. This yielded dual prices for all domestically produced commodities and for foreign exchange. We used these to compute a new set of purchasers' prices for Canada's export goods and a corresponding level of exports. We then iterated until the sequence of exports converged. All computations were performed on the VAX 8600 at McMaster University using the MINOS program (Murtagh and Saunders) supplemented by specially written subroutines.

4.5 Policy Simulations

4.5.1 Reference Solution

The reference solution was computed by setting all taxes and tariffs to their 1981 values.

4.5.2 Free Trade Agreement

A Canada US Free Trade Agreement (FTA) was simulated by setting all relevant tariffs to zero. Specifically, US tariffs against Canadian goods were removed by setting t^{f}_{ih} to zero for $h = 1$ in equation (A.7). Canadian tariffs against US goods were eliminated by setting the tariffs t^{c}_{ih} and t^{id}_{ihr} equal to zero for $h = 1$.

Specifically, let t^{cd}_{ih} denote the average duty collected per unit of commodity i imported for final consumption from source h, let t^{id}_{ihr} denote the average duty collected per unit of commodity i imported for intermediate use and let t^{cx}_{ih} and t^{ix}_{ih} be the non-tariff indirect taxes less subsidies on imports for final consumption and intermediate use respectively, and let t^{cs}_{i} be the tariff schedule rate for commodity i as supplied by the Economic Council of Canada (ECC). Let l^{id}_{ihr} and l^{ib}_{ihr} be the duties collected and border values of imports of i for intermediate uses as estimated by us from Trade of Canada data. Then we took

$$\begin{aligned} t^{cd}_{ih} &= t^{cs}_{i} \\ t^{id}_{ihr} &= \min(l^{id}_{ihr}/l^{ib}_{ihr}, t^{cs}_{i}) \end{aligned}$$

To remove US tariffs we replaced t^{cd}_{ih} and t^{id}_{ihr} by zero for $h = 1$.

~~When a FTA was simulated using the export demand elasticities provided by the E C, the solution algorithm converged only with great difficulty and the results indicated a loss in the value of Canadian consumption due to adverse terms of trade effects. This result was probably due to the fact that the trade weighted elasticity of demand for Canadian exports was low. To avoid this problem, we added 1.5 to the absolute value of the elasticity of demand for all Canadian manufactured goods exported to the United States.~~

4.5.3 Removing NTBs

Quantitative non-tariff measures and non-tariff barriers due to government procurement barriers were removed separately.

Canadian quantitative NTBs against the United States were removed by reducing the t^{c}_{ih} and t^{id}_{ihr} by the tariff equivalent of the NTBs. The tariff equivalents to Canadian NTBs were calculated by imposing upper bounds on the consumption imports c_{ih}. This yielded a shadow price t_{ih}^{eqc} (for $h = 1$) equal to the reduced gradient of c_{ih} less unity.

Specifically, let q_{ih}^{ntb} be the current quantitative NTBs on imports from the United States as provided by the EEC. Then the upper bound on c_{ih} was computed as

$$u_{ih} = c_{ih}^{0}(1 - q_{ih}^{\mathrm{ntb}}) \text{ for } k = 1$$

where c_{ih}^{0} is the value of c_{ih} in the reference year. Denoting by r_{ih}^{gc} the reduced gradient of c_{ih} in the constrained solution, we calculated t_{ih}^{eqc} as

$$t_{ih}^{eqc} = r_{ih}^{gc} - 1$$

We then replaced t_{ih}^{cd} and t_{ihr}^{id} by $t_{ih}^{cd} - t_{ih}^{eqc}$ and $t_{ihr}^{id} - t_{ih}^{eqc}$ respectively and recomputed the Canadian tariff.

We simulated the removal of US NTBs against Canada by increasing the multiplicative shift parameter k_{ih}^{e} in (A.7) by t_{ih}^{f} for $k = 1$, where t_{ih}^{f} is the percentage reduction in exports due to quantitative non-tariff barriers as estimated by the EEC.

To simulate the removal of Canadian government procurement barriers against the US we reduced the autonomous demand for Canadian goods by an amount equal to the estimated restrictions on government procurement and increased the autonomous demand for imports by a corresponding amount.

Specifically, let a_{ih}^{g} be the autonomous demand for commodity i which has been diverted from region h by Canadian government procurement practices and let t_{ih}^{p} be the estimated tariff equivalent of these procurement practices, as estimated by the EEC. Then we replace a_{i0} in equation (A.2) by

$$a_{i0}' = a_{i0} - a_{ih}^{g} \text{ for } h = 1$$

and $p_{ih}^{m}a_{ih}$in equation (A.1) by

$$(p_{ih}^{m}a_{ih})' = p_{ih}^{m}a_{ih} + (1 - t_{ih}^{p})a_{ih} \text{ for } h = 1$$

We simulated the removal of US government procurement barriers against Canada by increasing the multiplicative shift parameter k_{ih}^{e} in (A.7). Specifically, let d_{ih}^{pf} be foreign government procurement barriers against Canada as a percentage of base year exports. Then we replaced k_{ih}^{e} in equation (A.9) by

$$k_{ih}^{e\,\prime} = k_{ih}^{e} + d_{ih}^{pf}$$

and solved the model to obtain the new solution.

Appendix A

The Programming Trade Model

This appendix provides a complete mathematical description of the Programming Trade Model.

DIMENSIONAL PARAMETERS

N^H	Number of foreign nations or regions
N^I	Number of commodities
N^J	Number of industries
N^R	Number of trade patterns per industry

INDEX SETS

$H = \{0, \ldots, N^H\}$	nations
$I = \{1, \ldots, N^I\}$	commodities
$J = \{1, \ldots, N^J\}$	industries
$R = \{1, \ldots, N^R\}$	trade patterns

SUBSCRIPTS

$h \in H$ indexes nations ($h = 0$ denotes the home country)

$i \in I$ indexes commodities

$j \in J$ indexes industries

$r \in R$ indexes trade patterns

STRUCTURAL PARAMETERS

a_{ih} autonomous demand

a^{β} autonomous demand for labour

a^{t} autonomous indirect taxes less subsidies

b^{tr} exogenous supply of foreign exchange (US \$/a)

b^{γ} exogenous supply of real capital

d_{ih} distribution parameter, CES subutility function (dimensionless)

k^{e}_{ih} shift parameter in export demand equations

m^{g}_{ki} margin requirement for commodity k per unit consumption of commodity i (dimensionless)

p^{e}_{ih} foreign exchange earnings per unit of exports (1981US\$/1981C\$)

p^{km} foreign exchange requirement per unit of imported capital services (1981US\$/1981C\$)

p^{m}_{ih} foreign exchange requirement per unit of imports (1981US\$/1981C\$)

t^{c}_{ih} sales taxes and tariffs per unit consumption (dimensionless). N.B. there are no tariffs on domestic consumption (for which $h = 0$)

t^{f}_{ih} foreign tariffs on home country exports

t^{id}_{ihr} tariffs on intermediate commodity i imported from nation h

t^{iz}_{ir} non-tariff indirect taxes on intermediate commodities

t^{m}_{ih} tariff per unit of commodity i imported for final consumption (dimensionless)

t^q_{ir} weighted tariff on imports used to produce one unit of commodity i for intermediate use (dimensionless)

t^x_j indirect taxes less subsidies per unit of industry output (dimensionless)

α_{ij} input share of commodity i per unit output of industry j (dimensionless)

β_j labour requirement per unit output of industry j (dimensionless)

β^f_{ih} dummy variable equal to unity if i denotes labour as a final consumption good, zero otherwise

γ_j capital requirement per unit output

ϵ_i share of commodity i in aggregate consumption (dimensionless)

η^e_{ih} elasticity of demand for exports to nation h

η^n elasticity of labour supply

θ_{ihr} share of nation h in supply of commodity i for intermediate use, trade pattern r (dimensionless)

μ_{ih} marginal utility of final consumption (dimensionless)

μ^n marginal disutility of labour (dimensionless)

ρ_i CES substitution parameter (dimensionless)

ω_{ij} output share of commodity i per unit output of industry j (dimensionless)

PRIMAL VARIABLES

c_{ih} final consumption of commodity i from nation h (1981C\$/a). N.B. $h = 0$ denotes the home country.

e_{ih} exports of commodity i to nation h (1981C\$/a)

k^m imports of capital services

n quantity of labour supplied (1981C\$/a)

q_{ir} consumption of commodity i in intermediate use, trade pattern r (1981C\$/a)

x_j output of industry j (1981C\$/a)

z total indirect tax collections (1981C\$/a)

DUAL VARIABLES

p^{tr} real price of one unit of foreign exchange (1981C\$/1981US\$)

p_i^{w} price of one unit of domestically produced commodity i

p_i^{a} price of one unit of composite intermediate commodity i

p^{β} price of one unit of labour

p^{γ} price of one unit of capital services

p^{tax} price of one unit of tax revenue (numerically equal to unity)

PRIMAL CONSTRAINTS

$$\begin{aligned}\sum_{i\in I}\sum_{h=1}^{N^H} p_{ih}^{m} c_{ih} &+ \sum_{i\in I}\sum_{h=1}^{N^H} p_{ih}^{m}\theta_{ihr} q_{ir} \\ &+ p^{km}k^{m} - \sum_{i\in I}\sum_{h=1}^{N^H} p_{ih}^{e} e_{ih} + \sum_{i\in I}\sum_{h=1}^{N^H} p_{ih}^{m} a_{ih} \le b^{tr}\end{aligned} \tag{A.1}$$

$$\begin{aligned}&\sum_{h=1}^{N^H} e_{ih} + \sum_{h\in H}\sum_{k\in I}(1+m_{ki}^{g})c_{kh} \\ \sum_{r\in R}\theta_{ihr} q_{ir} + a_{i0} \;\le\; &\sum_{j\in J}\omega_{ij} x_j \qquad \forall i\in I\end{aligned} \tag{A.2}$$

$$\sum_{j\in J}\alpha_{ij} x_j \le \sum_{r\in R} q_{ir} \qquad \forall i\in I \tag{A.3}$$

$$\sum_{j\in J}\beta_j x_j + \sum_{i\in I}\sum_{h\in H}\beta_{ih}^{f} c_{i0} + a^{\beta} \le n \tag{A.4}$$

$$\sum_{j\in J}\gamma_j x_j \le b^{\gamma} + k^{m} \tag{A.5}$$

$$\sum_{i\in I}\sum_{h\in H} t^e_{ih}e_{ih} + \sum_{i\in I}\sum_{h\in H} t^c_{ih}c_{ih} + \sum_{j\in J} t^x_j x_j + \sum_{i\in I}\sum_{r\in R} t^q_{ir}q_{ir} + a^t \le z \tag{A.6}$$

DUAL CONSTRAINTS

$$\begin{aligned} \sum_{i\in I} p^\omega_i \omega_{ij} - \sum_{i\in I} p^\alpha_i \alpha_{ij} - p^\beta \beta_j &\le 0 \\ x_j\Big(\sum_{i\in I} p^\omega_i \omega_{ij} - \sum_{i\in I} p^\alpha_i \alpha_{ij} - p^\beta \beta_j\Big) &= 0 \\ &\forall j \in J \end{aligned} \tag{A.7}$$

$$\begin{aligned} p^\omega_i + \sum_{k\in I} p^\omega_k m^g_{ki} + p^\beta \beta^f_{ih} - \partial U/\partial c_{ih} &\ge 0 \\ c_{ih}\Big(p^\omega_i + \sum_{k\in I} p^\omega_k m^g_{ki} + p^\beta \beta^f_{ih} - \partial U/\partial c_{ih}\Big) &= 0 \\ &\forall i \in I, h = 0 \end{aligned} \tag{A.8}$$

$$\begin{aligned} p^{tr} p^m_{ih} + \sum_{k\in I} p^\omega_k m^g_{ki} + p^\beta \beta^f_{ih} - \partial U/\partial c_{ih} &\ge 0 \\ c_{ih}\Big(p^\omega_i + \sum_{k\in I} m^g_{ki} + p^\beta \beta^f_{ih} - \partial U/\partial c_{ih}\Big) &= 0 \\ &\forall i \in I, h \in \{1,\ldots,N^H\} \end{aligned} \tag{A.9}$$

$$\begin{aligned} p^{tr} \sum_{h=1}^{N^H} p^m_{ih}\theta_{ihr} + p^\omega_i \theta_{i0r} + t^q_{ir} - p^\alpha_i &\ge 0 \\ q_{ir}\Big(p^{tr} \sum_{h=1}^{N^H} p^m_{ih}\theta_{ihr} + p^\omega_i \theta_{i0r} + t^q_{ir} - p^\alpha_i\Big) &= 0 \\ &\forall i \in I,\ r \in R \end{aligned} \tag{A.10}$$

$$\begin{aligned} p^\omega_i + t^e_{ih} - p^{tr} p^e_{ih} &\ge 0 \\ e_{ih}(p^\omega_i + t^e_{ih} - p^{tr} p^e_{ih}) &= 0 \\ &\forall i \in I, h \in \{1,\ldots,N^H\} \end{aligned} \tag{A.11}$$

$$\begin{aligned} p^\beta - \partial D/\partial n &\ge 0 \\ n(p^\beta - \partial D/\partial n) &= 0 \end{aligned} \tag{A.12}$$

$$\begin{aligned} p^{tr} p^{km} - p^\gamma &\ge 0 \\ k^m(p^{tr} p^{km} - p^\gamma) &= 0 \end{aligned} \tag{A.13}$$

AUXILIARY FUNCTIONS

$$p^e_{ih} = p^{f0}_{ih}(e_{ih}/e^0_{ih} - k^e_{ih})^{1/\eta^e_{ih}} - t^f_{ih} \tag{A.14}$$

$$s^u_i = \sum_{h \in H} (d_{ih} c_{ih}{}^{-\rho_i})^{-1/\rho_i} \tag{A.15}$$

$$U = \prod_{i \in I} (s^u_i)^{\epsilon_i} \tag{A.16}$$

$$D = k^n n^{(\eta^e+1)/\eta^e} \tag{A.17}$$

$$F = U - D - z \tag{A.18}$$

SOLUTION

Let $\mathbf{z}$ be the vector of all activity variables. Then a solution to the model is a vector $\mathbf{z}^* \geq 0$ such that when export prices are held fixed at

$$p^e_{ih} = p^e_{ih}(e^*_{ih})$$

as given by equation (A.14), $\mathbf{z}^*$ solves the problem

$$\max_{\mathbf{z}} (U - D - z)$$

subject to equations (A.1) to (A.6).

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FOOTNOTES

[1] See Waelbroeck (1987) and Negishi (1960).

[2] We rely here on Waelbroeck's concise discussion of these criticisms, especially Taylor's (1975).

[3] This is why the objective function in our programming problem takes on a form which seems strange if the reader is thinking of optimal planning rather than general equilibrium modelling.

[4] Plus the direct labour component of final demand.